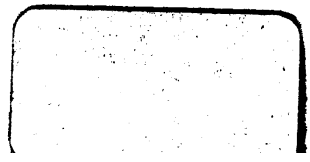

(From the 29th Annual Report of the Department of Geology and Natural Resources of Indiana, 1904, pp. 801-867. W. S. Blatchley, State Geologist.)

THE INSECT GALLS OF INDIANA.

By MEL. T. COOK.

INDIANAPOLIS:
WM. B. BURFORD, CONTRACTOR FOR STATE PRINTING AND BINDING.
1905.

INSECT GALLS OF INDIANA.

MELVILLE THURSTON COOK, PH. D.

Chief of the Department of Plant Pathology and Economic Entomology of the Republic of

For some time I have been working upon a monograph of the Insect Galls of North America. This monograph will be arranged with reference to the plants on which the galls are produced, and special attention will be given to the galls as pathological structures.

I should very much appreciate specimens and data from different parts of North America. Most specimens are best sent dry, and should be accompanied by name of host plant or sufficient material for determination. All material and data will be duly credited.

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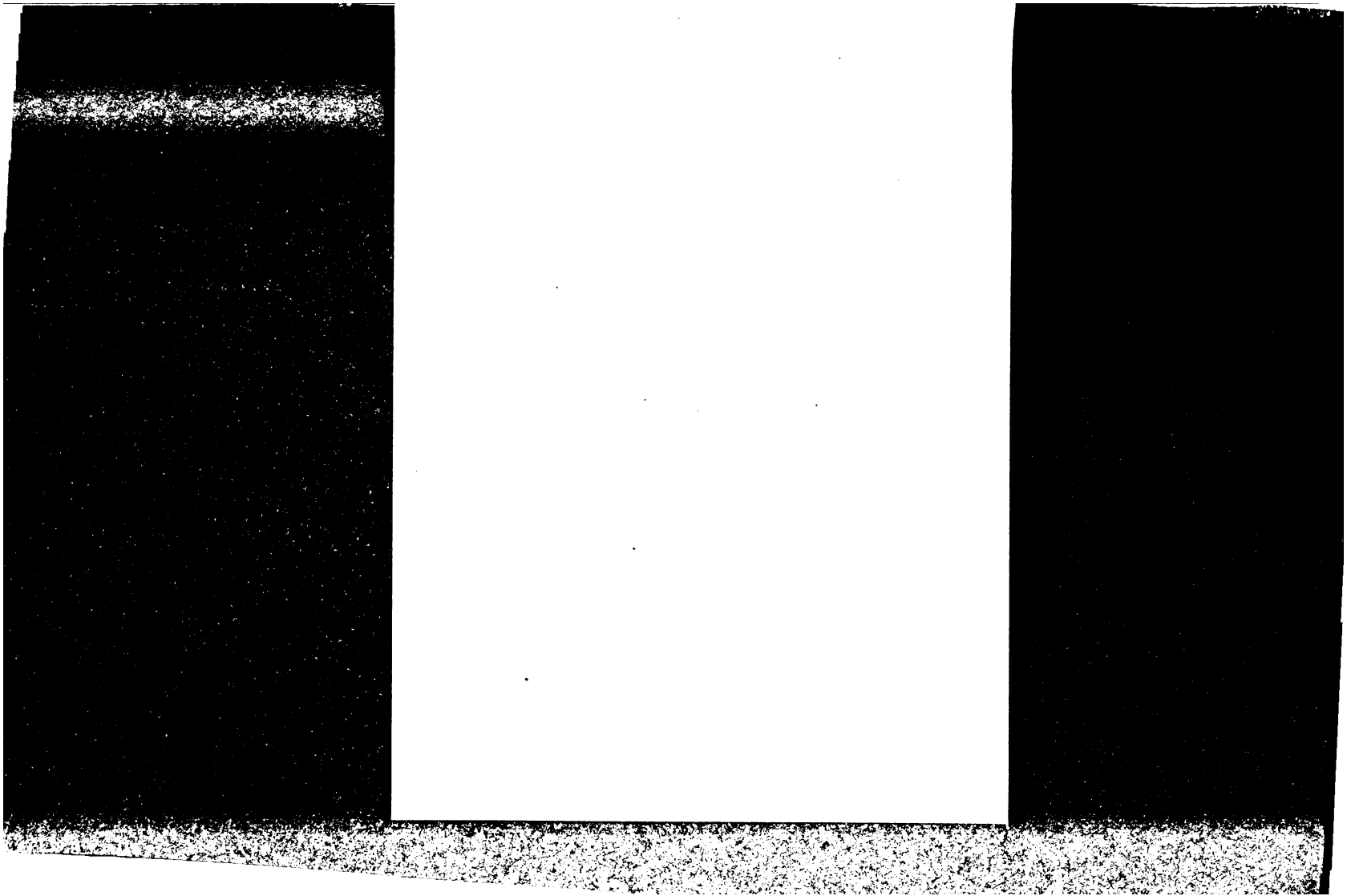
MEL. T. COOK,
Santiago de las Vegas,
Cuba.

Abnormal growths on plants may result from any one of several causes; a severe mechanical injury, a repeated mechanical injury or a chemical stimulus due to the action of some insect, a fungous growth, the combined action of insect and fungus, character of soil or fertilizer, or from unknown causes. We wish at this time to speak especially of these structures produced on plants by insects.

*Adler—"Ueber den Generations—wechsel der Eichen Gallwespen." Translation, "Alternating Generations, a Biological Study of Oak Galls and Gall Flies," by Charles R. Straton.



INSECT GALLS OF INDIANA.

MELVILLE THURSTON COOK, PH. D.

Chief of the Department of Plant Pathology and Economic Entomology of the Republic of Cuba; Santiago de las Vegas, Cuba. Formerly Professor of Biology in DePauw University, Greencastle, Indiana.

Some years ago I became interested in the study of gall insects and the structures produced by them. Having recently moved from the State I present this brief review of the subject, hoping that some one will be sufficiently interested to continue the work. I have also collected in the neighboring States of Illinois and Ohio, and from these States have a number of galls which I have not collected in Indiana, but which doubtless occur in the State.

Not only have a number of known species been overlooked, but there are also a great many undescribed species which will demand the attention of the student. The morphology and physiology is still an open field, but probably the most interesting field will be the rearing and studying the life history of these insects in the light of that masterly work by Dr. Hermann Adler on Alternating Generations.*

However, the student who takes up this work must expect to meet with a great many difficulties. It will be necessary to make careful observations and experiments through several seasons, and the problem will be very much complicated by the presence of numerous parasites and inquilines which in many cases belong to the same families as the gall makers.

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These abnormal growths have attracted the attention of the earliest writers. Redi,* like all other vitalists of his time, believed in a soul in each plant and that this soul controlled the formation of the egg, the gall, and the insect and determined their specific character.

Malpighi, a physician to Innocent XII, professor of medicine at Bologna, and later at Messina, was the earliest systematic writer on galls. In 1686 he published his "De Gallis," which gave very accurate descriptions of the galls then known to Italy and Sicily. He believed that in the case of the Cynips at least the insect secreted a poison which excited a fermentation in the acid and this resulted in the formation of the gall.

Among the modern European writers Hartig, Ratzeburg, Lacaze-Duthiers, Girard, Schenck, Reinhard, Taschenburg, Schlechtendal, Wachtl, Förster, Lichtenstein, Adler, Kieffer, Rubsaamen, Beyerinck, Straton, Nalepa, Mayr, Cameron and Rothera have added to our knowledge of these growths.

In America the pioneers in this subject were Baron C. R. Osten-Sacken, Bassett, Walsh, Riley, Fitch, Shimer and Harris, who have done most of the work. Among the modern workers who have written on this subject are Ashmead, Beutenmüller, Pergande, Cockerell, Garman and Gillette.

Nearly all plants are subject to gall formations which are incited by insects representing six entirely different orders as follows: Arachnida (Eriophyidæ or Phytoptidæ), Hemiptera (Aphididæ, Psyllidæ and Coccidæ†), Diptera (Cecidomyidæ and Trypetidæ), Coleoptera (Bupestidæ), Lepidoptera (Gelechidæ), and Hymenoptera (Cynipidæ and Tenthredinidæ).

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*Born A. D. 1626.

†Up to the present time coccid galls have been reported only from Australia by W. W. Froggatt and C. Fuller.

The writer has recently found a coccid gall producer on the Anones and figs in Cuba.

BIOLOGY OF GALL PRODUCING INSECTS.

ORDER—ARACHNIDA.

FAMILY—ERIOPHYIDÆ (PHYTOPTIDÆ).

All the members of this family are plant feeders and many of them produce galls. The adult mite has four legs near the anterior part of the body, the two posterior pairs being lacking (Fig. 1). The early students of the mite galls were unable to see the mites and therefore supposed the galls to be fungi. The mites pass the winter within the buds or possibly under the bark. With the coming of spring they attack the young leaves and produce their characteristic galls and deposit their eggs. The new generation spreads over the plant and produces new galls upon the young

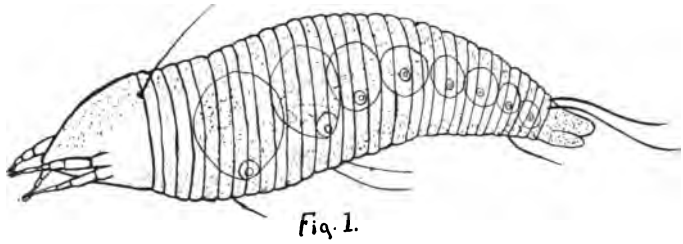


Fig. 1.

leaves and thus one generation follows another until the approach of winter makes it necessary for the adults to hibernate.

Certain species are very injurious to our cultivated plants. Among the most important is *Eriophyes pyri* Schenten, the pear leaf blister mite, which was introduced from Europe previous to 1870. Like many other introduced insects they are more injurious in this country than in their original home. It is widely distributed throughout the pear growing regions and probably exists in Indiana, although I have not collected it here.* The mites pass the winter in the buds and in the spring attack the young leaves, forming red blister-like galls about one-fourth inch across, which become green and then turn brown.

* Prof Slingerland in a Bulletin of the Cornell Experiment Station reports that it can be destroyed by the using a 5 to 7 per cent. kerosene emulsion applied with a spray early in the spring before the leaves appear. Aldrich in Bulletin No. 26 of the Idaho Agricultural Experiment Station reports that in Idaho it is necessary to use a 20 per cent. kerosene emulsion.

Eriophyes oleivorus Ashmead, attacks the oranges and lemons in California and Florida. It causes the leaves to curl, the orange fruit to become brown and the lemon fruit to become silvery. The oranges thus affected are said to ship better than unaffected fruit and although not so pleasing to the eye are said to be more juicy, They are frequently sold on the market under the name of russet oranges.

Another European Species is *Eriophyes phloecoptes* Nalepa (*Cecidoptes pruni* Amerling), which produces small subspherical galls at the base of the buds of plum trees.

ORDER—HEMIPTERA.

Two families of this order, *Aphididæ* and *Psyllidæ* produce galls which range in complexity from a simple leaf curl to a very high degree of complexity.

FAMILY—APHIDIDÆ.

This is the family of the plant lice (Fig. 2) which includes a number of gall makers. They are small, soft bodied insects which suck the juices of plants through a tubular mouth. There are a

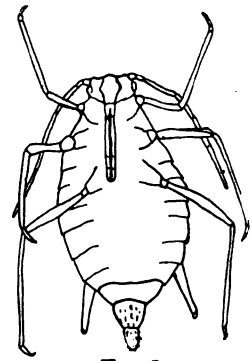


Fig. 2.

large number of species, and practically all kinds of vegetation are subject to their attacks.

The various species differ widely in their development and the following is intended merely for a general description. The first spring brood usually comes from winter eggs and is known as the

wingless agamic brood. This brood reproduces rapidly without males, but from time to time winged agamic individuals appear and fly to new plants and form new colonies. With the approach of winter a sexual generation is produced in which the males may or may not have wings but the females are always wingless. These females are impregnated and lay the winter eggs which produce the wingless agamic spring brood.

Among the most injurious is the grape Phylloxera, *Phylloxera vastatrix* Planchon (Figs. 46, 47). It is a native of the United States east of the Rocky Mountains, where it seldom does much damage. It was introduced into France previous to 1863 upon vines from America. In its new home it was soon recognized as a serious pest and in 1884 about 2,500,000 acres, or more than one-third of the vineyards of France, were affected, which resulted in great loss. It was afterwards introduced into California, probably on vines from France, and also possibly from the eastern United States, and has proved a serious pest. It has four well recognized stages: (1) the sexual form, consisting of a single fall generation; (2) the leaf gall stage, consisting of from one to five generations; (3) the root gall form, consisting of several generations; (4) the winged form, which is a single summer generation. The leaf gall form may be omitted.

Schizoneura lanigera Hansen, attacks the apples, producing scars on the branches (Fig. 3a), and also galls on the roots (Fig. 3b). It is very conspicuous because of the woolly excretions (Fig. 3c). I have not collected this gall in Indiana, but it occurs here.

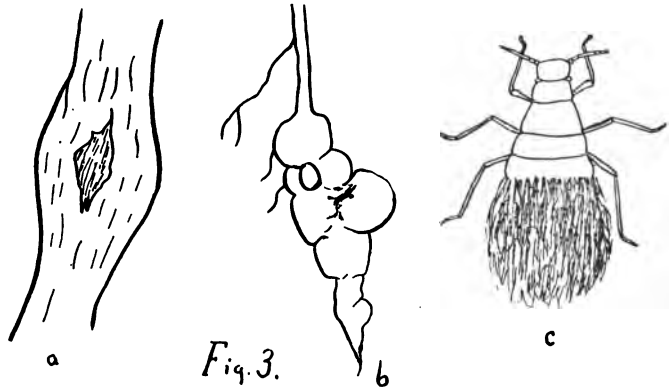


Fig. 3.

Many of our forest and shade trees are subject to attacks from these insects, which seriously distort them and reduce their vitality.

FAMILY—PSYLLIDÆ.

The gall makers of this family are very similar to the Aphididæ, but are not so numerous. They are especially common on the hackberry *(Celtis occidentalis)*, but are also found on some other plants.

ORDER—DIPTERA.

Two families of this order produce galls, the *Cecidomyidæ* and the *Trypetidæ*.

FAMILY—CECIDOMYIDÆ.

This is a family of very minute and delicate insects (Fig. 4) which are very numerous and which cause considerable loss of

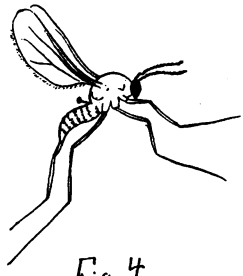


Fig. 4

crops. They are usually easily recognized by the larvæ usually being red or orange colored.

FAMILY—TRYPETIDÆ.

This is the family to which our common housefly belongs and is represented by a single species *Trypeta solidaginis* Fitch (Fig. 36), which produces a hard, spherical gall on our common golden-rods (*Solidago canadensis*).

ORDER—LEPIDOPTERA.

FAMILY—GELECHIIDÆ.

The only gall maker of this order that I have found in the State is *Gnorimoschema Gallæsolidaginis* Riley, which produces an elongated hollow gall on our common golden-rods (*Solidago canadensis*) (Fig. 48), but is of no economic importance. A few other species of this order produce galls.

ORDER—COLEPTERA.

FAMILY—BUPRESTIDÆ.

A very few species of this order produce galls. One species, *Agrilus ruficollis* Fabr., is very destructive to the raspberries and blackberries in certain parts of the United States. The eggs are deposited in the canes in July or August and soon hatch; the larvæ immediately bore into the sap wood and cause irregular elongated galls known as the raspberry gouty gall. The winter is passed in the gall and the adult insect emerges in June or July. It is frequently known as the "red-necked Agrilus" because of the copper colored thorax which is sharply contrasted with the black wing cover.

ORDER—HYMENOPTERA.

Two families of this order, the *Tenthredinidæ* and the *Cynipidæ* contain a large number of gall makers.

FAMILY—TENTHREDINIDÆ.

Comparatively few species of this family produce galls and I have not collected any of them in Indiana, although I have collected them in Ohio. They are most abundant on the willows.

FAMILY—CYNIPIDÆ.

The members of this family (Fig. 5) produce the most complex of all the insect galls. However, not all the insects of this family produce galls; many of them are not associated with galls,

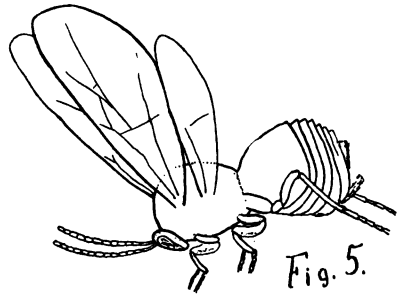


Fig. 5.

while others are parasites or inquilines on galls produced by other members of this family. They are most abundant on the various species of the oaks, but are also found on the roses, blackberries and a few other plants.

All galls contain tannin, and in the past have been important articles of commerce. The most important was *Cynips tinctoria* L. of Turkey, which was extensively used and is now occasionally used in medicine as an astringent in the treatment of chronic diarrhoea, chronic dysentery and in poisoning by vegetable alkaloids. It has also been extensively used in the manufacture of ink, but is now almost entirely supplanted by other methods.

This family has been the subject of some very interesting studies on alterations of generations. In 1861 Baron Osten-Sacken, who was then working in the United States, advanced the theory that the so-called agamous species were sexual but that the males were developed from different galls. This theory proved incorrect, and in 1864 Walsh, an American entomologist, claimed that he had reared from what appeared to be exactly similar galls on one occasion both sexes of *Cynips spongifica* and at another time only females, but that these females were *Cynips aciculata.* These observations were undoubtedly incorrect, and it was not until 1873, after Walsh's death, that Bassett, another American, discovered the true key to the conditions. Bassett observed great numbers of irregular galls on the petioles and midribs of *Quercus bicolor*, and that in June both males and females emerge from them. Also that late in the summer an entirely different shaped gall was formed on the young twigs of the same oak and that from these galls females only emerged the following spring. As a result of these studies Bassett came to the conclusion that the sexual generation caused galls from which emerged the agamous generation and that this generation caused galls from which emerged the sexual generation, thus giving true alternation of generations. He furthermore expressed the idea that it was probable that all species of Cynips produced two generations each year.

It, however, remained for Dr. Hermann Adler of Schleswig, Germany, to actually demonstrate that a large number of the Cynipidæ did produce two generations, but that a few species were strictly parthenogenetic.

MORPHOLOGY AND EVOLUTION OF INSECT GALLS.

The gall producing species of the Arachnida, Hemiptera and Diptera deposit their eggs on the surface of the plant and after hatching the larvæ penetrate the tissues. The Hymenoptera puncture the tissues and deposit their eggs within the plant.* With the exception of the Tenthredinidæ there is no change in the plant tissues until the hatching of the larvæ. The young larvæ immediately attack the young and growing tissues of the plant and the plant immediately responds by active cell division which results in the formation of a gall.

The form and histological characters of the gall depends upon the order, family and genus to which the insect belongs and not upon the taxonomic position of the plant.

In the Arachnida we find the simplest form of a gall and also galls which are more complex than the simplest Hemiptera galls. The simplest Eriophyidæ galls consist of an abnormal production of trichomes (Fig. 6), among which the minute insects live. The

Fig. 6.

second type is that represented by the Erineum anomalum† (Fig. 50) on the walnut; in this case we have a thickening of the tissues resulting in the bending of the petiole or vein of the leaf and the excessive production of trichomes over the surface. The third and most complex type is represented by the formation of a cavity lined with trichomes (Fig. 7) as in the case of *Eriophyes ulmi, E. abnormis, E. quadripes, E. acericola.*

In all cases the cells of the plant lose their normal character, are more numerous, smaller, more compact, and can be separated by a more or less definite boundary into two zones; an inner nutritive zone of very small cells which are very rich in protoplasm, and an outer protective zone of larger cells which contain less protoplasm but considerable quantities of tanin.

The Hemipterous galls range from a very simple leaf curl to the

*The method of deposition of eggs by gall making Coleoptera and Lepidoptera is still an unsettled question.

† Probably Acarus caulis Walsh.

very complex Psyllidæ galls, which are more complex than most of the Dipterous galls. The first type of Hemipterous gall is represented by *Schizoneura Americana* in which we have a wrinkling and curling of the leaf. As in the case of the Eriophyidæ galls, the normal structure of the leaf is lost, the cells are smaller,

Fig. 7

more numerous and less compact and can be separated into two indistinct zones, the nutritive and the protective.

In the second type we have the formation of a pouch of a definite shape (Fig. 40). The cells show the same general morphological character as the preceding, except that the cells are elongated in the direction of the long axis of the gall. Such galls are also well provided with fibro-vascular tissues.

The third and most complex type is found in *Pachysylla celtidis-mammæ* (Figs. 8, 37). In this gall we have a greater dif-

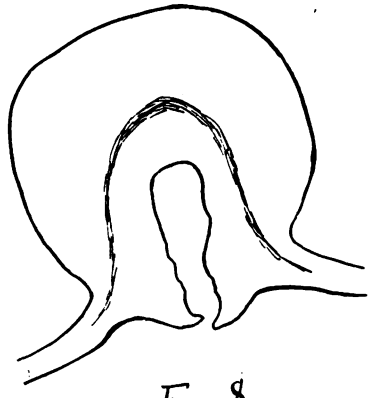


Fig. 8.

ferentiation of cells resulting in the formation of sclrenchyma cells for the protection of the insect.

Among the Dipterous insects the most conspicuous gall makers belong to the Cecidomyidæ. These galls are so varied in character that it is difficult to divide them into groups with distinct types. However, the same general characters as those just referred to are more or less well defined. If the larvæ does not penetrate the tissues as in the case of *Cecidomyia gleditschiæ* (Fig. 32) the cells become elongated from the midrib to the margin of the leaf, i. e., parallel to the surface of the gall except near the margin, where they are irregular. If the larvæ penetrate the tissues as in the case of *Cecidomyia verrucicola* the mesophyll is at first removed. As the gall increases in size the inner layer of cells divide rapidly and gradually reduce the size of the larval chamber.

The Coleopterous and Lepidopterous galls have not been so thoroughly studied, and I am unable at this time to give any satisfactory discussion of their development.

The Hymenopterous galls, especially the Cynipidæ, present the most complex structures and the most complete line of evolutionary development. The simplest of these galls show the same general characters as the galls previously referred to, i. e., (1) an increase in number of cells which are smaller and more compact than the original mesophyll, and a loss of the palisade cells; (2) separation into two more or less well defined zones.

The second type is well illustrated by Callirhytis tumifica (Fig. 9a), in which case we have four rather poorly defined zones; an

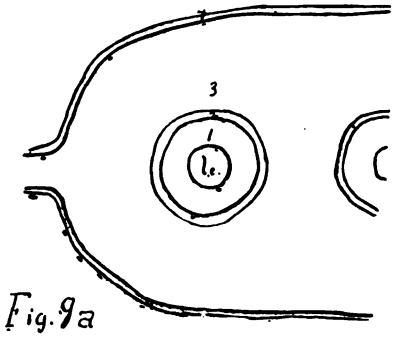


Fig. 9a

inner zone of nutritive cells which are rich in protoplasm, a second zone of small cells corresponding to the protective zones of

the more complex galls, but without the formation of sclerenchyma, a third very thick zone of parenchyma cells and a fourth or outer epidermal zone.

The third type is illustrated by *Amphibolips inanis* (Figs. 9b, 17) in which the four zones are well defined; the second zone developed into well defined sclerenchyma; the third zone separated so that a few cells cling to the sclerenchyma, but the greater part remain attached to the epidermis and the two parts connected by

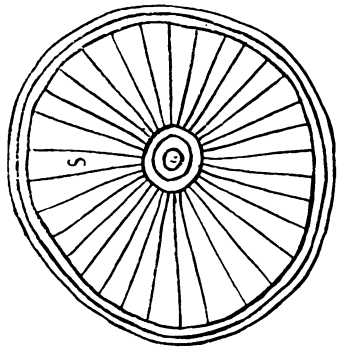


Fig. 9b.

fibro-vascular bundles. The larval chamber is thus surrounded by a nutritive zone which is enclosed by a sclerenchyma zone which is in turn surrounded by a small amount of parenchyma, which is connected with an outer wall of parenchyma and epidermis by means of fibro-vascular bundles.

The fourth type may be illustrated by *Callirhytis papillatus* which is similar to the preceding, except that the larval chambers (two or three in this species) are suspended by single elongated cells.

The fifth type may be illustrated by *Biorhiza forticornis* (Figs.

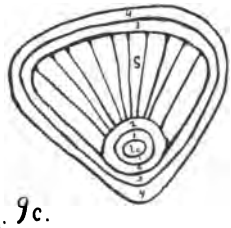


Fig. 9c.

9c, 26), in which the four zones are present, but the separation into inner and outer walls occurs on one side only.

The sixth type may be illustrated by *Amphibolips confluentus* (Fig. 16), in which the four zones may be recognized, but in which the space between the inner and outer walls is bridged by a mixture of fibro-vascular bundles and long filamentous cells.

The seventh type may be illustrated by *Dryophanta palustris* (Fig. 22) in which we have the four well defined zones but the inner wall is entirely separated from the outer, leaving a small body rolling freely within the large hollow sphere which is thus formed by the outer wall.

The origin of these various forms and degrees of complexity is still an obscure problem which becomes more difficult by the introduction of three primary factors. In our consideration of problems of natural selection we ordinarily consider two primary factors, the organism and its environment. The environmental factor may include, and in fact usually does include, several factors, such as climatic conditions and other organisms. In the study of galls, however, we have three primary factors as follows: (1) The gall producer, which is endeavoring to secure food and to provide defense against its many enemies, especially parasites; (2) the host plant, which is endeavoring to withstand the injury produced by the gall maker; (3) the enemies of the gall maker, primarily parasites, inquilines and occasionally small animals which may feed upon the galls.

Adler states that certain European galls produce secretions which are attractive to ants and that these ants defend the gall from parasites. Also, that secretions are frequently produced on tufts of long hair among which the parasites become entangled. These methods do not seem to be of much importance among our native galls.

He also states that the thick parenchyma zone, the dense sclerenchyma tissue of the protective zone, the large size of the gall, and the hollow sphere with the larval chamber suspended in the center are all protective devices which make it difficult for the parasites to reach the larvæ. These methods of protection are very common in our American Cynipidous galls, and I am unable to explain their origin from any other cause. The *Callirhytis tumifica, Amphibolips sculpta, Holcaspis globulus* and *Amphibolips prunus* illustrate the thickening of the parenchyma zone; *Andricus petiolicola* and *Acraspis crinacei* illustrate the thickening of the

protective or sclerenchyma zone; *Amphibolips confluentus* illustrates the large size; *Amphibolips inanis* and *Holcaspis centricola* illustrate the suspension of the larval chamber in the center of a hollow sphere; and *Dryophanta palustris* illustrates a still more highly developed type by the formation of a free rolling larval chamber within a hollow sphere.

Adler also speaks of the formation of tannin, disagreeable odor, etc., as being protection against birds and other small animals; and the same may be said of our native American galls.

One might readily accept the idea that the "law of natural selection" would develop the two primary factors, the organism and its enemies, the one to defend and the other to attack. However, it is not easy to understand just why a plant should develop a gall for the protection of the gall maker, which is undoubtedly the enemy of the plant. It may be that each species of gall producing insects gives a slightly different stimulus or stimulates slightly different tissues, and that this results in galls of different character. However, granting that there is a slightly different stimulus in each species, we can then understand how a simple gall might have developed complexity which would be protective to the insect; i. e., any variation in the stimulus resulting in a variation in the gall which would be beneficial to the insect would probably be perpuated in the next generation, while a variation in stimulus resulting in a variation in the gall which would not be beneficial, or would be injurious, would be less likely to be perpetuated in the next generation. Continued variation in stimulus, resulting in variations in galls might eventually result in the formation of a gall of great complexity.

From the preceding observations it appears that in the evolution of the gall there are really but two primary factors, (1) the insect struggling to secure food and defend itself and, (2) its many enemies, also struggling to secure food and thus perpetuate their kind. The host plant is important only in so far as it furnishes more or less suitable conditions for the insect gall maker. However, it presents another problem in that it must in a greater or less degree develop a certain power of resistance against the gall maker.

The gall making habit must have originated independently not only in each of the orders, but also in each of the families represented. In other words, must have arisen independently in at least eleven different points in the insect world.

CAUSES INDUCING GALL FORMATION.

Many theories have been advanced as to the existing factors in the formation of the gall, but up to the present time the evidence leads us to believe that, with the exception of the *Tenthredinidæ,* the stimulus is mechanical rather than chemical.

When the egg is placed within the tissues it is necessary that it be so placed that the larva begin feeding upon the formative cells (Cambium zone) in order that a gall may be produced, and it is probably necessary for the larvæ of those insects which deposit their eggs upon the surface to stimulate the formation of cells in order that a gall may be produced. Up to the present time the observations and studies of other writers as well as my own lead me to believe that, with the exception of the Tenthredinidæ, the stimulus is purely mechanical. Adler in his studies upon *Nematus Vallisnierii,* which produces a gall upon *Salix amygdalina* and Beyerinck in his studies of *Nematus coprea,* which also produces a gall upon *S. amygdalina,* came to the conclusion that the gall was produced as the result of a secretion by the parent at the time of depositing the eggs. This seems evident since, according to their observations, the gall commenced before the hatching of the larvæ.

Many of the Cynipidæ also secrete a liquid at the time of depositing the egg, but this does not seem to stimulate gall formation because it is evident that there is no increase in cell formation until the larva emerges from the egg. However, it may be possible that the larva produces certain secretions or that certain excrements given off by it acts as stimuli upon the formative cells of the plant. Mr. W. A. Cannon in discussing a Cecidomyid gall on the Monterey pine (California) says that the "larvæ take their food only by absorption through the surface of the body," also that "there is no indication that the hypertrophy is either caused or affected by any substance deposited with the eggs."

INDIANA GALLS.

This catalogue gives descriptions of 66 species of gall producing insects representing 25 genera and five orders of insects (including Arachnida). The host plants represent ten orders, fourteen families and nineteen genera, as follows:

Orders.	*Families.*	*Genera.*
Salicales	Salicaceæ	Salix.
		Populus.
Juglandales	Juglandaceæ	Hicoria.
		Juglans.
		Quercus.
Urticales	Ulmaceæ	Celtis.
		Ulmus.
Rosales	Hamamelidaceæ	Hamamelis.
	Rosaceæ	Rosa.
		Rubus.
	Caesalpinaceæ	Gleditsia.
	Drupaceæ	Prunus.
Sapindales	Aceraceæ	Acer.
	Anacardiaceæ	Rhus.
Rhamnales	Vitaceæ	Vitis.
Malvales	Tiliaceæ	Tilia.
Gentianales	Oleaceæ	Fraxanus.
Campanulales	Compositæ	Solidago.
Umbellales	Cornaceæ	Cornus.

(The synonymy and bibliography for the following species is fairly complete, except for the family Eriophyidæ).

HYMENOPTERA.

CYNIPIDÆ.

RHODITES BICOLOR Harris. Fig. 10.

Cynips bicolor—

T. W. Harris, Treat. Insects Mass., 1841, p. 399.
Osten-Sacken, Stettin. Entom. Zeitg. XXII, 1861, p. 415.
T. W. Harris, Insects Mass., 3d Ed., 1862, p. 548.

Rhodites bicolor—

Osten-Sacken, Proc. Entom. Soc. Philadelphia II, 1863, pp. 43 and 48.
Riley, Amer. Entomol. and Botan. II, 1870, p. 309.
Provancher, Addit. faun. Canada, Hymen, 1886, p. 160.
Ashmead, Bull. I Colo. Biol. Assoc., p. 38, 1890.
Bassett, Trans. Amer. Ent. Soc. 1890, p. 63.
Beutenmüller, Cat. of Gall Insects, 1892, p. 246.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, p. 6, 1904.
Gillette, Ent. News, Vol. III, p. 246, 1892.

This is a spherical monothalamous gall, about ¼ to ½ inch in diameter. It is covered with a great many long slender spines.

Fig. 10.

In the summer it is yellowish green, frequently tinged with red. It is formed singly or in clusters from the leaves, which are frequently completely utilized in its formation. It persists on the twigs throughout the winter. Common on many species of the wild rose. Has wide distribution throughout the United States and Canada.

RHODITES RADICUM Osten-Sacken. Fig. 11.

Rhodites radicum—

Osten-Sacken, Proc. Entom. Soc. Phil. II, 1863, p. 42 and 46.
Riley, 1st Ann. Rep. Insects of Missouri, 1869, p. 13.
Riley, Amer. Entomol. and Botan. II, 1870, p. 181.
Riley, Ins. Inj. Veg., p. 304, 1883.
Ashmead, Bull. I, Colo. Biol. Assoc., p. 38, 1890.
Bassett, Trans. Amer. Ent. Soc. 1890, p. 62.
Webster, Ohio Agri. Ex. Station. Bull. 45, 1892.
Beutenmüller, Cat. of Gall Insects, 1892, p. 246.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 6.
Gillette, Ent. News, Vol. III, p. 246, 1892.

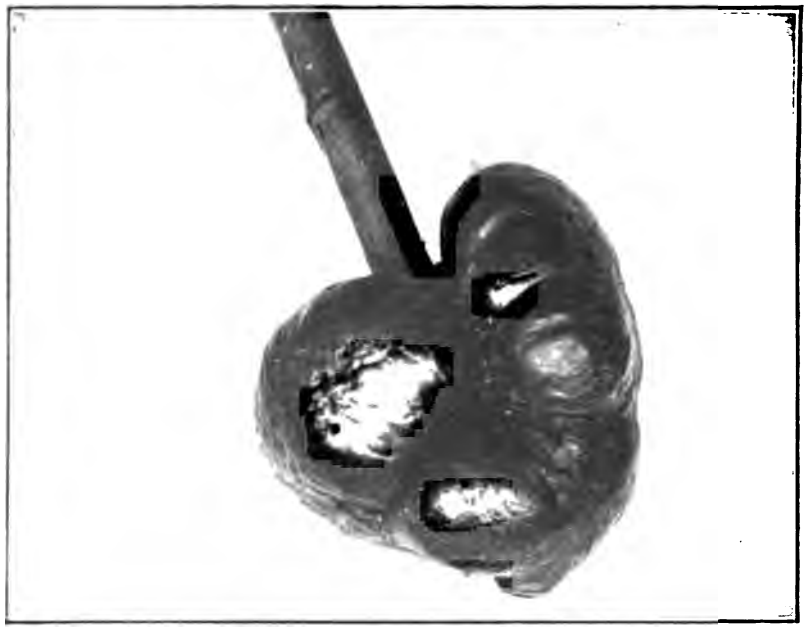


Fig. 11.

A large, irregular, smooth, reddish brown polythalamous gall, frequently two inches in diameter, surrounding the root of the wild rose, with a deep depression both above and below at its place of attachment. Common in many States. A single Indiana specimen was sent to me by Mr. F. C. Senour, of New Augusta, Indiana, collected on Rosa carolina L.

RHODITES GLOBULUS Beutenmüller. Fig. 12.

Rhodites globulus—

Beutenmüller, Cat. of Gall Insects, 1892, p. 247.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 7.

This gall is smooth, polythalamous, spherical or oblong, encircles the branch of our *Rosa carolina*. About ¾ inch to 1½ inches in diameter. Can be readily distinguished from Rhodites radicum by its being on the twigs instead of on the roots, much smaller, and by the fact that it is not depressed at the points of its contact with the stem. Only previous record from New York.*

*Probably described by Osten-Sacken in Proc. Ent. Soc. Phil. Vol. II., p. 42.

Fig. 12.

RHODITES DICHLOCERUS Harris. Fig. 13.

Cynips dichlocerus—

T. W. Harris, Treat. Insects Mass., 1841, p. 399.
Osten-Sacken, Stettin. Entom. Zeitg. XXII, 1861, p. 415.
T. W. Harris, Treat. Insect. Mass., 3d Ed., 1862, p. 549.

Fig. 13.

Rhodites dichlocerus—

Osten-Sacken, Proc. Entom. Soc. Phil. II, 1863, p. 42 and 46.
Ashmead, Trans. Amer. Ent. Soc. Vol. XIV, 1887, p. 148.
Beutenmüller, Cat. of Gall Insects, 1892, p. 247.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, p. 7.

This gall is an elongated, spindle-shaped, woody swelling of the stems, about 1 to 1½ inches in length. Common on *Rosa carolina* in many States.

DIASTROPHUS CUSCUTÆFORMIS Osten-Sacken. Fig. 14.

Diastrophus cuscutæformis—

Osten-Sacken, Proc. Ent. Soc. Phil. Vol. II, pp. 39, 45.
Webster, Ohio Agri. Ex. Stat. Bull. 45, 1892, p. 156.
Beutenmüller, Cat. of Gall Insects, 1892, p. 249.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, p. 9, 1904.


Fig. 14.

Small, globular, monothalamous, stem gall provided with one or more spines. Usually in groups and closely pressed together. A single specimen on *Rubus villosus* collected in Steuben County by Prof. W. A. Kellerman, of the Ohio State University. Known to occur in New York and Maryland.

DIASTROPHUS NEBULOSUS Osten-Sacken. Fig. 15a, b.

Cynips (Diastrophus?) nebulosus—

Osten-Sacken, Stettin. Entom. Zeitg. XXII, 1861, p. 415.

Diastrophus nebulosus—

Osten-Sacken, Proc. Ent. Soc. Phil. Vol. II, 1863, p. 36.
Riley, Amer. Ent. Vol. II, 1870, p. 159-160.
Fuller, Amer. Ent. Vol. III, 1880, p. 63.
Provancher, Natural. Canad. XII, 1881, p. 235.
Provancher, Faun. entom. Canada. Hymen, 1883, p. 550.
Ashmead, Trans. Amer. Ent. Soc. Vol. XIV, 1887, p. 148.
Saunders, Ins. Inj. to Fruit, p. 318.
Webster, Ohio Agri. Ex. Stat. Bull. 45, 1892, p. 157.
Slosson, Ent. News, Vol. VIII, p. 237, 1897.
Beutenmüller, Cat. of Gall Insects, 1892, p. 249.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 9.

Fig. 15a.

A very large, oblong, polythalamous, stem gall with deep longitudinal grooves, 1 to 3 inches in length, and 1 to 1½ inches in diameter. A dark green, gradually becoming reddish brown with the approach of spring. The insect emerges in the spring of the year following the formation of the gall. Common on *Rubus villosus*.

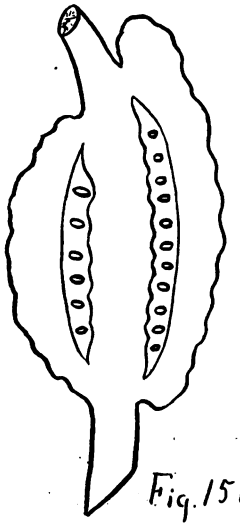


Fig. 15b.

AMPHIBOLIPS CONFLUENTUS Harris. Fig. 16.

Cynips confluentus—

Harris, Rep. Ins. Inj. Veget. 1st Ed., 1841, p. 397.
Harris, Rep. Ins. Inj. Veget. 2d Ed., 1852, p. 433.
Harris, Rep. Ins. Inj. Veget. 3d Ed., 1862, p. 546.
Osten-Sacken, Proc. Ent. Soc. Phil. Vol. I, p. 53.
Walsh, Proc. Ent. Soc. Phil. Vol. II, p. 481.

Cynips aciculata—

Osten-Sacken, Proc. Ent. Soc. Phil. Vol. I, pp. 56 and 245.
Osten-Sacken, Proc. Ent. Soc. Phil. Vol. IV, p. 354.
Walsh, Proc. Ent. Soc. Phil. Vol. II, pp. 443, 462, 481.
Walsh, Am. Ent. Vol. II, p. 330.
Walsh & Riley, Am. Ent. Vol. I, p. 103.

Fig. 16.

Cynips coccineæ—

Osten-Sacken, Proc. Ent. Soc. Phil. Vol. I, pp. 243, 248.
Osten-Sacken, Proc. Ent. Soc. Phil. Vol. IV, p. 354.
Walsh, Proc. Ent. Soc. Phil. Vol. II, p. 481.

Amphibolips coccineæ—

Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 294.
Packard, 5th Rep. U. S. Ent. Com., p. 104.

Cynips spongifica—

Osten-Saken, Proc. Ent. Soc. Phil. Vol. I, pp. 244, 248.
Osten-Saken, Proc. Ent. Proc. Soc. Phil. Vol. IV, p. 347.
Walsh, Proc. Ent. Soc. Phil. Vol. II, p. 443, 452.
Walsh, Am. Ent. Vol. II, p. 330.
Walsh & Riley, Am. Ent. Vol. I, p. 103.

Amphibolips spongifica—

Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 294.
Gillette, 27th Mich. Agri. Rep., 1888.
Packard, 5th Rep. U. S. Ent. Com., p. 104.

Amphibolips confluentus—

Beutenmüller, Cat. of Gall Insects, 1892, p. 250.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 10.

This is a spherical, smooth-leaf gall with thin wall. Inside it is filled with a spongy substance, in the center of which is a dense walled chamber containing a single large larva. This gall is 1 to 2 inches in diameter and of a pale green color. Late in the season it becomes brown and is very dry and brittle. This species presents a good example of dimorphism. Osten-Sacken describes both male and female coming from these galls in June. These he calls *Cynips (Amphibolips) spongifica.* He also describes a later brood of females only coming forth in October or the following spring, and these he named *Cynips (Amphibolips) acculata.* But B. D. Walsh demonstrated that the second brood was merely a brood of polymorphic females. This species occurs on *Quercus tinctoria, Q. rubra, Q. coccinea,* and *Q. nigra.*

AMPHIBOLIPS INANIS Osten-Sacken. Fig. 17.

Callaspida confluens—

Fitch, 5th Rep. Nox. Ins. Trans. N. Y. State Agri. Soc., 1858, p. 817.

Cynips inanis—

Osten-Sacken, Proc. Entom. Soc. Phil. I, p. 58.
Osten-Sacken, Proc. Entom. Soc. Phil. II, p. 242.
Walsh, Proc. Entom. Soc. Phil. III, p. 403.
Walsh, Proc. Entom. Soc. Phil. II, pp. 457, 458, 481.
Osten-Sacken, Proc. Entom. Soc. Phil. IV, p. 354.
Walsh & Riley, Amer. Entomol. I, p. 104.
Riley, 1st Ann. Rep. Insects, Missouri, p. 14.

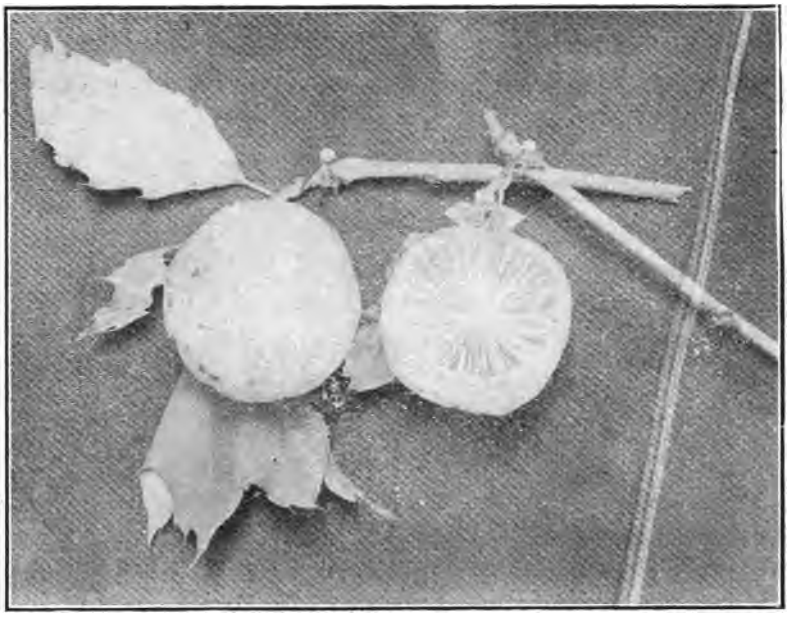


Fig. 17.

Amphibolips inanis—

Mayr, 20, Jahresber, Comm. Oberralsch I, Bez. Wien, 1881, p. 27.
Gillette, 27th Mich. Agri. Rep., 1888.
Gillette, Psyche V, p. 184.
Ashmead, Trans. Amer. Ent. Soc. Vol. XII, p. 294.
Packard, 5th Report U. S. Ent. Comm. 1890, p. 105.
Beutenmüller, Cat. of Gall Insects 1892, p. 251.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 11.

This is a spherical gall with thin outer wall. In the center is a larval chamber which is supported by filaments which radiate to the outer wall. This gall is from ½ to 1 inch in diameter, light green in color, with a number of small black dots on the surface. Occurs on *Quercus coccinea* and *Q. rubra.*

AMPHIBOLIPS PRUNUS Walsh. Fig. 18.

Cynips prunus—

Walsh, Proc. Entom. Soc. Phil. III, p. 639.
Walsh & Riley, Amer. Entomol. I, p. 104.

Amphibolips prunus—

Mayr, 20 Jahresber. Comm. Oberrealsch I, Bez. Wien, 1881, p. 27.

Gillette, Psyche V, 1889, p. 184.

Ashmead, Trans. Amer. Ent. Soc. Vol. XIV, 1887, p. 130.

Lintner, 4th Rep. Insects New York 1888, p. 42, 44.

Packard, 5th Rep. U. S. Ent. Com., p. 105.

Beutenmüller, Cat. of Gall Insects, 1892, p. 252.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, p. 12, 1904.

Fig. 18.

This is an oval, fleshy, but solid, monothalamous gall found growing from the side of the acorn. It is a bright red, gradually shading into yellow towards the center. The gall is ½ to 1 inch in diameter. The insect comes out in the late spring of the year following the formation of the gall. A single specimen was sent to me by Mr. F. C. Senour, of New Augusta, Indiana. I was unable to determine the species of the host, but it is reported from other states to occur on *Quercus rubra* and *Q. tinctoria.*

AMPHIBOLIPS SCULPTA Bassett.

Cynips sculptus—

Bassett, Proc. Entom. Soc. Phil. II, p. 324.

Cynips sculpta—

Walsh, Proc. Entom. Soc. Phil. II, p. 84.

Osten-Sacken, Proc. Entom. Soc. Phil. IV, p. 356.

Amphibolips sculpta—

Mayr, 20 Jahresber. Comm. Oberrealsch I, Bez. Wien, 1881, p. 27.
Gillette, Psyche V, p. 184.
Gillette, Proc. Iowa Acad. Sci. Vol. I, pt. 2, p. 111, 1892.
Gillette, 27th Mich. Agri. Rep. pp. 468, 477, 1888.

A smooth, spherical, soft, succulent, monothalamous leaf gall about ½ to ¾ inches in diameter and very much resembling green grapes. Specimens growing on *Quercus rubra* were collected near Laporte, Indiana, by Mr. Fred L. Sims. It is also said to occur on *Quercus tinctoria.*

ANDRICUS SEMINATOR Harris. Fig. 19.

Cynips seminator—

Harris, Rep. Ins. Inj. Veget. 1st Ed., 1841, p. 399.
Harris, Rep. Ins. Inj. Veget. 2d Ed., 1852, p. 434.
Fitch, 5th Rep. Nox. Ins. Trans. N. Y. Agricul. Soc. 1858, pp. 315, 813.
Osten-Sacken, Proc. Entom. Soc. Phil. I, 1861, p. 69.
Osten-Sacken, Stettin. Entom. Zeitg. XXII, 1861, p. 410.
Harris, Rep. Ins. Inj. Veget. 3d Ed., 1862, p. 548.
Walsh, Proc. Entom. Soc. Phil. II, 1863, p. 465.
Walsh, Proc. Entom. Soc. Phil. II, 1864, pp. 489, 490.

Cynips (Andricus) seminator—

Osten-Sacken, Proc. Entom. Soc. Phil. IV, 1865, p. 351.

Cynips seminator—

Walsh & Riley, Amer. Entomol. II, 1869, p. 71.

Andricus (Callirhytis) seminator—

Mayr, 20 Jahresber. Comm. Oberrealsch I, Bez. Wien, 1881, p. 28.

Andricus seminator—

Gillette, Psyche V, 1889 p. 185.
Gillette, 27th Mich. Agri. Rep., pp. 468 and 477, 1888.

Cynips seminator—

Packard, Rep. U. S. Entom. Comm. V, 1890.

Fig. 19.

Andricus (Callirhytis) seminator—

Beutenmüller, Cat. of Gall Insects, 1892, p. 254.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 13.

Andricus seminator—

Gillette, Proc. Iowa Acad. Sci. Vol. I, pt. 2, p. 111, 1892.

A very small, monothamous, compound gall. These galls are always collected in masses and covered with a woolly substance which gives the mass a more or less spherical appearance. This mass varies from 1 to 2 inches in diameter and is either pure white or tinged with red, but late in the autumn becomes rusty brown. Very common on *Quercus alba.*

ANDRICUS PAPILLATUS Osten-Sacken. Fig. 20.

Cynips papillata—

Osten-Sacken, Proc. Entom. Soc. Phil. I, p. 64.

Osten-Sacken, Stettin. Entom. Zeitg. XXII, 1861, p.409.

Cynips (Andricus) papillatus—

Osten-Sacken, Proc. Entom. Soc. Phil. IV, 1865, p. 352.

Andricus (Callirhytis) papillatus—

Ashmead, Trans. Amer. Entom. Soc. XII, 1885, p. 295.

Packard, 5th Rep. U. S. Ent. Com., p. 105.

Beutenmüller, Cat. of Gall Insects, p. 255.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4. 1904. p. 14.

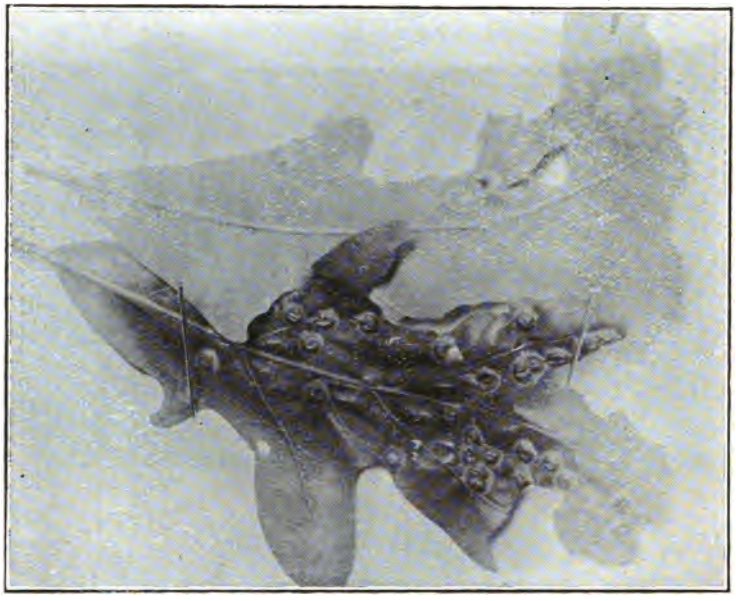


Fig. 20.

Small gall projecting from both surfaces of the leaf. In the center are two or three chambers each containing a single larva. These chambers are suspended by filaments which radiate to the outer wall. Each gall is about 1/8 to 1/4 inch in diameter. Common on the oaks.

ANDRICUS CLAVULA Bassett. Fig. 21.

Cynips arbor—

Fitch, 5th Rep. Nox. Ins. Trans. N. Y. Agricul. Soc., 1858, p. 809.

Bassett, Proc. Ent. Soc. Phil. Vol. III, p. 686.

Cynips tuber—

Bassett, Proc. Ent. Soc. Phil. Vol. III, p. 685.

Cynips clavuli—

Bassett, Proc. Ent. Soc. Phil. Vol. IV, p. 351.

Osten-Sacken, Proc. Ent. Soc. Phil. Vol. IV, p. 379.

Andricus (Callirhytis) clavula—

Mayr, 20 Jahresber. Comm. Oberrealsch I, Bez. Wien, 1881, p. 28.

Bassett, Am. Nat. Vol. XVI, p. 246.
Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 294.
Packard, 5th Rep. U. S. Ent. Com., p. 105.

Andricus clavula—
Gillette, Psyche V, 1889, p. 184.
Gillette, 27th Mich. Agri. Rep., 1888.

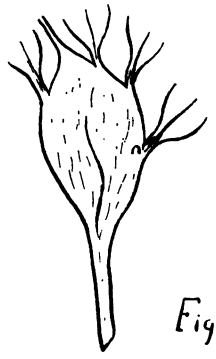


Fig. 21.

Andricus (Callirhytis) clavula—
Beutenmüller, Cat. of Gall Insects, 1892, p. 255.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 15.

A club shaped gall formed from the bud at the tip of the twig. Green in summer but in winter same color as twig. Common on *Quercus alba.*

ANDRICUS PALUSTRIS Osten-Sacken. Fig. 22.

Cynips palustris—
Osten-Sacken, Proc. Ent. Soc. Phil. Vol. I, p. 62; Vol. III, p. 359.
Osten-Sacken, Trans. Am. Ent. Soc. Vol. III, p. 54.

Andricus (Callishytis) palustris—
Bassett, Am. Nat. Vol. XVI, p. 246.
Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 294.
Packard, 5th Rep. U. S. Ent. Com., p. 105.
Beutenmüller, Cat. of Gall Insects, 1892, p. 256.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, p. 15, 1904.

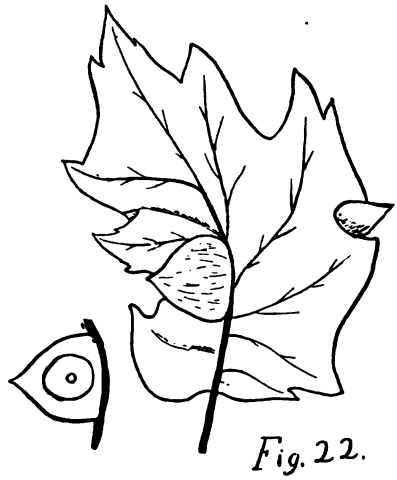


Fig. 22.

A smooth, spherical, green, succulent leaf gall about ½ inch in diameter. The inside is hollow, with a small whitish, globular body about 1-10th inch in diameter. This small body rolls freely and contains a single chamber with a single larva. The adult insect comes out in May. Common on *Quercus palustris.*

ANDRICUS PETIOLICOLA Bassett. Fig. 23.

Cynips petiolicola—

Bassett, Proc. Entom. Soc. Phil. II, 1863, p. 325.
Walsh, Proc. Entom. Soc. Phil. II, 1864, p. 487.

Cynips petiolicola—

Gillette, Psyche V, 1889, p. 1862.

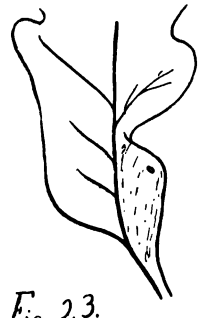


Fig. 23.

Cynips (Andricus) petiolicola—

Osten-Sacken, Proc. Ent. Soc. Phil. Vol. IV, p. 379.
Bassett, Am. Nat. Vol. XVI, p. 246.
Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 295.
Gillette, 27th Mich. Agri. Rep., 1888.
Packard, 5th Rep. U. S. Ent. Com., p. 105.
Beutenmüller, Cat. of Gall Insects, 1892, p. 257.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 16.

A dense, woody, club shaped, polythalamous gall on the petiole or midrib of the leaf of *Quercus alba, Q. prinus, Q. bicolor, Q. obtusiloba.*

ANDRICUS LANA Fitch. Fig. 24.

Cynips lana—

Fitch, 5th Rep. Nox. Trans. N. Y. State Agricul. Soc., 1858, p. 814.

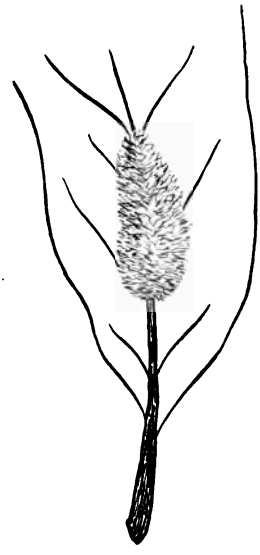


Fig. 24.

Andricus lana—

Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 295.
Packard, 5th Rep. U. S. Ent. Com., p. 105.
Beutenmüller, Cat. of Gall Insects, 1892, p. 257.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 16.

Numerous, small and collected in a mass on one of the principal veins and covered with a white or buff colored woolly mass. Common on *Quercus rubus* and *Q. alba.*

ANDRICUS FEMORATUS Ashmead.

Andricus femoratus—

Ashmead, Trans. Amer. Entom. Soc. XIV, 1887, p. 141.

A small, thin walled spherical gall. In the center is a single small chamber held in place by fine radiating filaments. On *Quercus rubra.*

CYNIPS PISUM Fitch.

Cynips pisum—

Fitch, 5th Rep. Nox. Ins. N. Y. Trans. Agri. Soc. XVIII, p. 818.

Osten-Sacken, Proc. Entom. Soc. Phil. I, 1861, p. 59.

Osten-Sacken, Proc. Entom. Soc. Phil. I, 1862, p. 250.

Osten-Sacken, Proc. Entom. Soc. Phil. IV, 1865, p. 361.

Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 303.

Beutenmüller, Cat. of Gall Insects, 1892, p. 258.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 18.

Spherical, polythalamous gall. The surface finely netted with depressions between which are small elevations. About ½ inch in diameter and pale greenish yellow in color. Attached to veins on either under or upper surface of the leaf. Common on *Quercus alba.*

ACRASPIS ERINACEI Walsh. Fig. 25.

Cynips erinacei—

Walsh, Proc. Ent. Soc. Phil. Vol. II, p. 483.

Cynips erinaceus—

Osten-Sacken, 7th Rep. U. S. Geol. and Geog. Sur., 1873, 1874.

Acraspis erinacei—

Mayr, 20 Jahresber. Comm. Oberrealsch I, Bez Wein, 1881, p. 29.

Mayr, Genera der Gallben. Cynipid, p. 29.

Bassett, Am. Nat. Vol. XVI, p. 246.

Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 295.

Ashmead, Bull. No. 3, Kans. Agri. Ex. Station, App., p. IV, 1888.

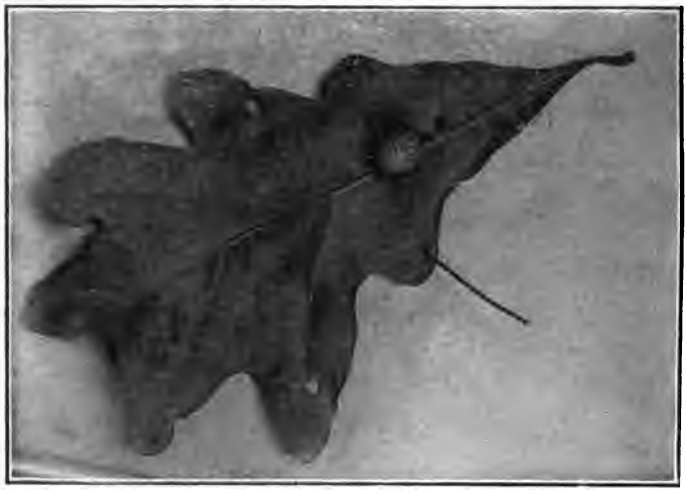


Fig. 25.

Ashmead, Bull. No. 1, Colo. Biol. Assoc., p. 38.
Packard, 5th Rep. U. S. Ent. Com., p. 106.
Gillette, 27th Mich. Agri. Ex. Station Rep., pp. 470-477, 1888.
Gillette, Psyche V, 1889, p. 186.
Gillette, Proc. Ia. Acad. Sci. Vol. I, pt. 2, p. 112, 1892.
Beutenmüller, Cat. of Gall Insects, 1892, p. 259.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 18.

An oval, polythalamous gall, ¼ to ½ inch in diameter, and attached by a single point to the rib on the upper surface of the leaf. Finely netted with fissures and covered with long spines of a bright red color. Common on *Quercus rubra.*

XANTHOTERAS FORTICORNIS Ashmead. Fig. 26.

Cynips ficus—
Fitch, 5th Rep. Nox. Ins. Trans. N. Y. Agri. Soc., 1858, p. 812.
Osten-Sacken, Pro. Ent. Soc. Phil. Vol. IV, p. 368.

Cynips forticornis—
Walsh, Proc. Ent. Soc. Phil. Vol. II, p. 490.

Teras forticornis—
Osten-Sacken, Pro. Ent. Soc. Phil. Vol. IV, p. 379.

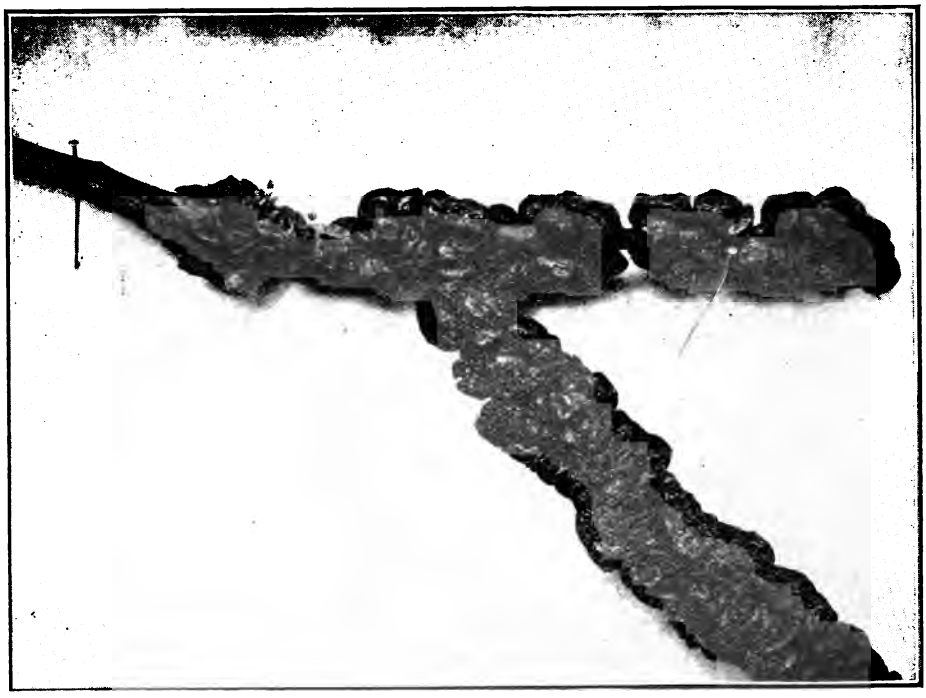


Fig. 26.

Acraspis forticornis—

Bassett, Am. Nat. Vol. XVI, p. 246.
Ashmead, Trans. Am. Ent. Soc. Vol. XII, p. 296.
Packard, 5th Rep. U. S. Ent. Com., p. 107.

Biorhiza forticornis—

Mayr, 20 Jahresber. Comm. Oberrealsch I, Bez. Wien, 1881, p. 32.
Gillette, 27th Mich. Agri. Rep., pp. 470 and 477.
Gillette, Psyche V, 1889, p. 186.
Gillette, Proc. Iowa Acad. Sci. Vol. I, pt. 2, p. 113.
Ashmead, Bull. I, Colo. Biol. Assoc., p. 38, 1890.
Beutenmüller, Cat. of Gall Insects, p. 259, 1892.
Beach, Proc. Iowa Acad. Sci. II, p. 94, 1895.

Xanthoteras forticornis—

Ashmead, Psyche X, p. 149, 1903.

Small fig-shaped galls, closely packed in dense clusters around the young twigs. An inner chamber containing a single larva is

fastened directly to one side of the outer wall and on the other side is connected with the outer wall by means of filaments. It is pale yellow, often tinged with red, but in winter becoming brown. Frequently on *Quercus alba.*

HOLCASPIS GLOBULUS Fitch. Fig. 27.

Callaspidia globulus—

Fitch, 5th Rep. Nox. Ins. N. Y. State Agricul. Soc., 1858, p. 811.

Packard, 5th Rep. U. S. Ent. Com., p. 111.

Cynips globulus—

Fitch, 5th Rep. Nox. Ins. N. Y. State Agri. Soc., p. 312.

Osten-Sacken, Proc. Ent. Soc. Phil., Vol. I, p. 67.

Osten-Sacken, Stettin. Entom. Zeitg. XXII, 1861, p. 410.

Bassett, Proc. Entom. Soc. Phil., Vol. II, p. 328.

Walsh, Proc. Entom. Soc. Phil., Vol. II, p. 488.

Cynips globuli—

Osten-Sacken, Proc. Entom. Soc. Phil., Vol. IV, p. 350.

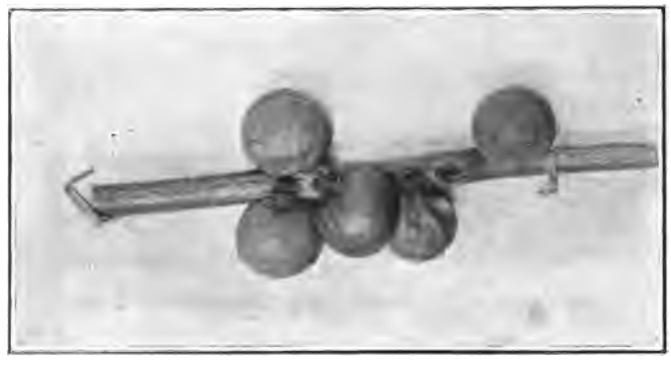


Fig. 27.

Holcaspis globulus—

Mayr, 20 Jahresber. Comm. Oberrealsch I, Bez. Wien, 1881, p. 35.

Bassett, Am. Nat. Vol. XVI, p. 246.

Packard, 5th Rep. U. S. Ent. Com., p. 106.

Gillette, 27th Mich. Agri. Rep., pp. 470 and 478, 1888.

Gillette, Psyche V, 1889, p. 187.

Gillette, Proc. Iowa Acad. Sci. Vol. I, pt. 2, p. 113, 1892.

Beutenmüller, Cat. of Gall Insects, 1892, p. 260.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 19.
Patton, Ent. News III, p. 104.

Spherical, smooth, corky, monothalamous, twig galls. The larva is contained in oval white, shell-like central structures. Yellow, frequently tinged with red, but brown in winter. One-half to three-fourths inch in diameter. Common on *Quercus alba.*

HOLCASPIS CENTRICOLA Osten-Sacken. Fig. 28.

Cynips centricola—

Osten-Sacken, Proc. Entom. Soc. Phil. I, 1861, p. 58.
Osten-Sacken, Proc. Entom. Soc. Phil. IV, 1865, p. 350.

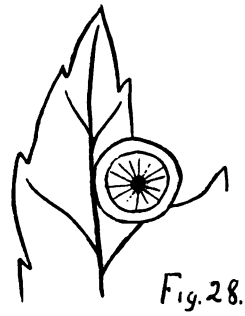


Fig. 28.

Holcaspis centricola—

Ashmead, Trans. Amer. Entom. Soc. XII, 1885, p. 296.

A spherical gall very similar to Amphibolips inanis O.-S., except that it is smaller and in fact might be very easily mistaken for A. inanis. On *Quercus obtusiloba.*

DRYOPHANTA RADICOLA Ashmead. Fig. 29.

Dryophanta radicola—

Ashmead, Proc. of the U. S. Nat. Mus. Vol. XIX, p. 116, 1896.

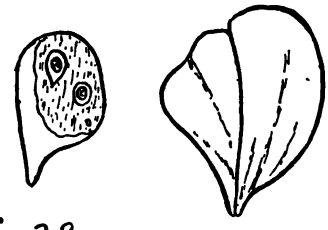


Fig. 29.

A fig-shaped, polythalamous gall produced in a cluster on the stem just below the surface of the ground. Yellow and when partly exposed to the sun becomes bright red. On *Quercus alba.*

NEUROTERUS RILEYI Bassett. Fig. 30.

Cynips sp.————

J. A. W., Amer. Entomol. III, 1880, p.153.

Cynips Rileyi—

Bassett, Amer. Nat. XV, 1881, p. 149.

Packard, Rep. U. S. Entom. Com. V, 1890, p. 114.

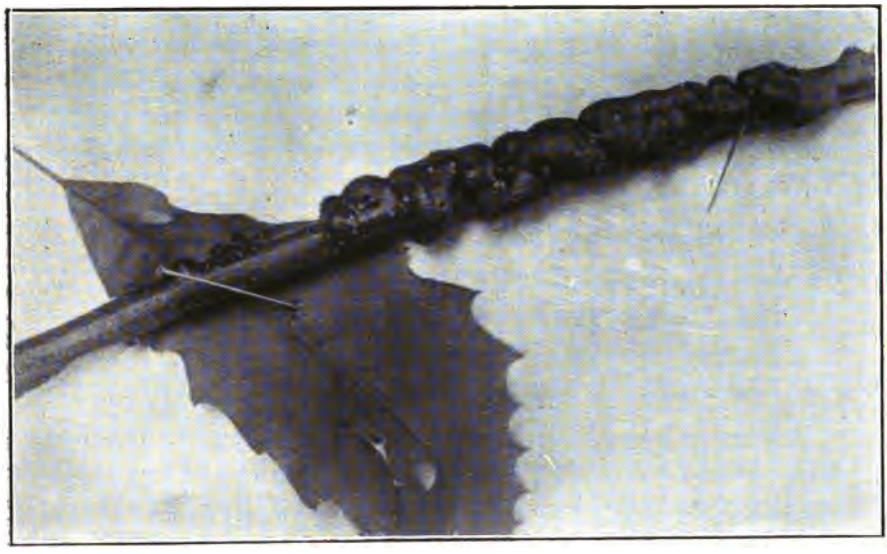


Fig. 30.

Neuroterus Rileyi—

Mayr, 20 Jahresber. Com. Oberrealsch I, Bez. Wien, 1881, p. 37.

Clustered swellings on the young stems of *Quercus prunus.* Each gall is polythalamous. Forms in the late summer and the flies emerge the following spring.

CALLIRHYTIS TUMIFICA Osten-Sacken.

Callirhytis tumifica—

Osten-Sacken, Proc. Entom. Soc. Phil., 1865, p. 356.

A fleshy polythalamous leaf gall extending on both surfaces of the leaf. One-eighth to ¼ inch, rarely ½ inch in diameter. Common on *Quercus tinctoria* and *Q. alba.*

DIPTERA.

CECIDOMYIDÆ.

CECIDOMYIA VERRUCICOLA Osten-Sacken.

Cecidomyia verrucicola—

Osten-Sacken, Can. Ent. Vol. VII, p. 200.
Beutenmüller, Cat. of Gall Insects, 1892, p. 264.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 24.

A small gall projecting from both surfaces of the leaf. About 1-5 inch in diameter. In the fall it opens on the under side by means of a circular lid which frequently remains attached by one edge. Common on *Tilia Americana.* Reported from New York; probably very widely distributed.

CECIDOMYIA CERASI-SEROTINÆ Osten-Sacken.

Cecidomyia cerasi-serotinæ—

Osten-Sacken, Trans. Am. Ent. Soc. Vol. III, p. 346.
Beutenmüller, Cat. of Gall. Insects, 1892, p. 265.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 25.

A more or less spherical, fleshy gall formed from the terminal bud. Bright red in color and frequently with one or two leaves growing from the side. Rare. Also reported from New York. On *Prunus serotina.*

CECIDOMYIA PELLEX Osten-Sacken. Fig. 31.

Cecidomyia pellex—

Osten-Sacken, Mon. Dipt. N. Am., pt. 1, p. 199.
Beutenmüller, Cat. of Gall Insects, 1892, p. 265.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 26.

I am not sure that my determination of this gall is correct. It is formed as a result of the swelling of the petiole of the midrib of the leaflets. Frequently the entire leaflet is destroyed leaving a cluster of bean-shaped structures. The larvæ leave the gall in the latter part of June and early in July. Common on *Fraxinus Americana.*

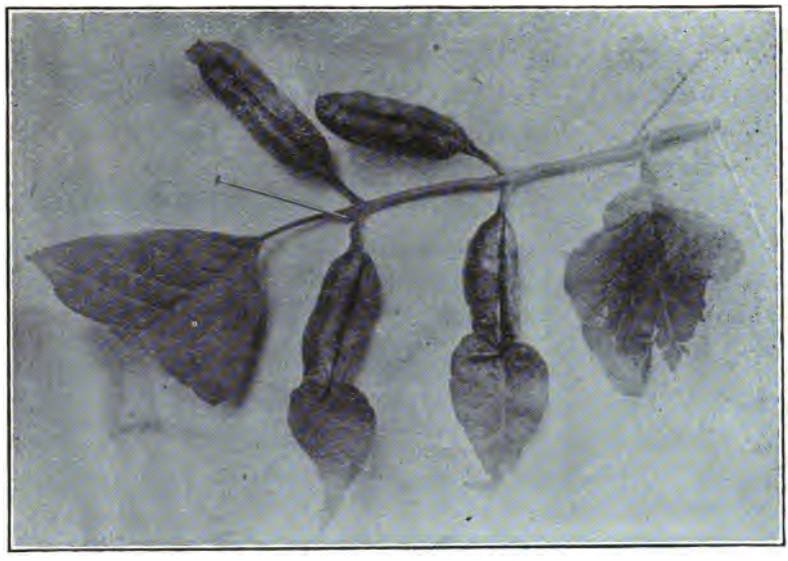


Fig. 31.

CECIDOMYIA GLEDITSCHIÆ Osten-Sacken. Fig. 32.

Cecidomyia gleditschiæ—

Osten-Sacken, Proc. Ent. Soc. Phil. Vol. VI, p. 219.

Beutenmüller, Cat. of Insect Galls, 1892, p. 266.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 26.

The leaflets are so folded along the central vein that the edges are brought together, forming a pod. Sometimes only the tip of

Fig. 32.

the leaflet is thus deformed. The life history is completed within the gall and the adult insect emerges in June and July. Common on *Gleditschia triacanthos.*

CECIDOMYIA HOLOTRICHA Osten-Sacken.

Cecidomyia holotricha—

Osten-Sacken, Mon. Dipt. N. Am., pt. I, p. 193.
Glover, MS. Notes from my Journal, pl. XI, Fig. 23.
Beutenmüller, Cat. of Gall Insects, 1892, p. 266.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 26.

A small sub-globular or onion-shaped, pubescent, monothalamous gall. Frequently so abundant on the underside of the leaf as to cause it to shrivel. Common on *Hicoria ovata.*

CECIDOMYIA TUBICOLA Osten-Sacken.

Cecidomyia tubicola—

Osten-Sacken, Mon. Dipt. N. Am., pt. I, p. 192.
Glover, MS. Notes from my Journal, Dipt. pl. XI, fig. 25.
Beutenmüller, Cat. of Gall Insects, 1892, p. 267.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 27.

Small, cylindrical, monothalamous galls inserted in a concave protuberance on the underside of the leaf and very easily broken. Green, but when mature, a deep brown. Common on *Hicoria alba.* Also reported from New York.

CECIDOMYIA STROBILOIDES Osten-Sacken. Figs. 33, 34.

Cecidomyia strobiloides—

Osten-Sacken, Mon. Dipt. pt. I, p. 203.
Walsh and Riley, Am. Ent. Vol. I, p. 105.
Packard, Guide to the Study of Insects, p. 377.
Glover, MS. Notes from my Journal, pl. XI, fig. 15.
Beutenmüller, Cat. of Gall Insects, p. 892, p. 267.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 28.

An apical, cone-shaped, bud gall formed of closely imbricated leaves. Makes its appearance in May and is fully grown in July. The mature insects do not emerge until early the following spring. Very abundant on the willows.

CECIDOMYIA SILIQUA Walsh.

Cecidomyia siliqua—

Walsh, Proc. Ent. Soc. Phil. Vol. IV, p. 223-288.

This gall is a swelling of the young twigs and is about 1½ inches in length. It is monothalamous and contains a single larva.

Fig. 33.

CECIDOMYIA CLAVULA Beutenmüller.

Cecidomyia clavula—

Beutenmüller, Cat. of Gall Insects, 1892, p. 269.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 29.

A club-shaped, monothalamous gall formed on the terminal twigs of Cornus florida. Same color as the twigs. I have collected this gall in Putnam County. It is also reported from New York.

CECIDOMYIA PILULÆ Walsh.

Cynips pilulæ—

Walsh, Proc. Ent. Soc. Phil. Vol. II, p. 481.
Walsh and Riley, Am. Ent. Vol. II, p. 29.
Riley, 5th Rep. U. S. Com., p. 206.
Beutenmüller, Cat. of Gall Insects, 1892, p. 269.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 30.

A solid, fleshy, polythalamous gall occurring usually in great numbers on the upper surface of the leaf. On the under surface of the leaf opposite the gall is a small green projection of the leaf

structure. When young the gall is yellow or pale brown, but in August or September it becomes bright red or brown. The size is variable and frequently two or more galls unite. As it approaches maturity the surface cracks irregularly. On most species of the oak. Very widely distributed.

CECIDOMYIA SOLIDAGINIS Loew.

Cecidomyia solidaginis—

Loew, Mon. Dipt. N. Am. pt. I, p. 194.

Glover, MS. Notes from my Journal.

Beutenmüller, Bull. Amer. Mus. Nat. Hist. Vol. IV, No. 1, p. 271, 1892.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 31.

An apical gall which prevents the elongation of the stem and causes the leaves to be reduced and accumulated into a rosette mass. Very common on the golden-rods *(Solidago canadensis)*.

Fig. 34.

SCIARA OCELLARIS Osten-Sacken. Fig. 35.

Cecidomyia ocellaris—

Osten-Sacken, Mon. Dipt. N. Am. pt. I, p. 199.

Glover, MS. Notes from my Journal.

Sciara ocellaris—

Comstock, Rep. U. S. Dept. Agricul., 1881, p. 202.

Packard, 5th Rep. U. S. Ent. Com., 1890, p. 411.

Beutenmüller, Bull. Amer. Mus. Nat. Hist. Vol. IV, No. 1, 1892, p. 273.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 33.

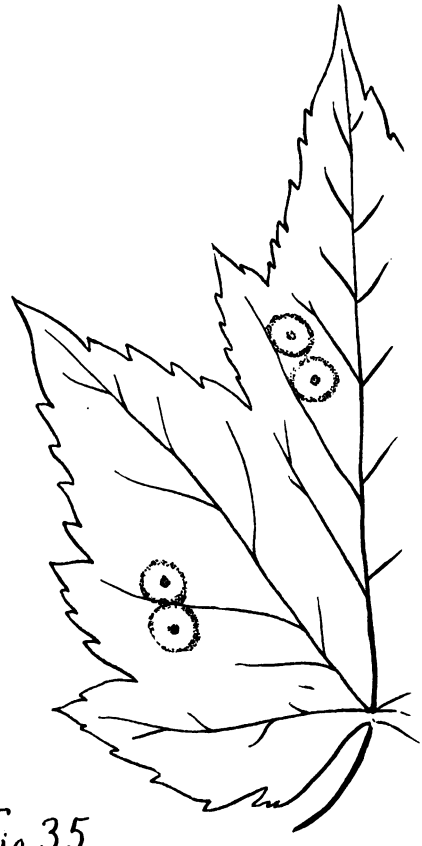


Fig. 35.

An eye-like, circular spot, light yellow in color with a red central dot. Frequently entirely green or yellow. Common on the red maple (*Acer rubrum*). Reported from New York. Probably as widely distributed as the host plant.

TRYPETIDÆ.

TRYPETA SOLIDAGINIS Fitch. Fig. 36.

Acinia solidaginis—

Fitch, 1st Rep. Nox. Ins. Trans. N. Y. State Agricul. Soc. Vol. XIV, p. 771.

Trypeta solidaginis—

Loew, Mon. Dipt. N. Am., p. 82.
Glover, MS. Notes from my Journal.
Beutenmüller, Cat. of Gall Insects, p. 274.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 33.

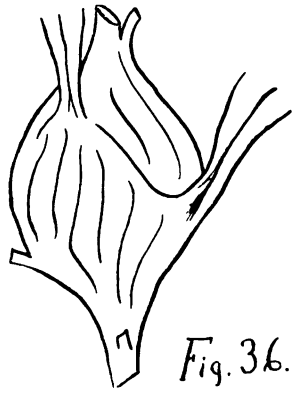


Fig. 36.

A solid, spherical, monothalamous gall on the stem of the golden-rod (*Solidago canadensis*). Fully developed in August. The mature insect is as large or larger than the common housefly and emerges the following spring. Common and widely distributed.

HEMIPTERA.

PSYLLIDÆ.

PACHYSYLLA CELTIDIS-MAMMÆ Riley. Fig. 37.

Pachysylla celtidis-mammæ—

Riley, Johnson's Universal Encyclopedia, 1876.
Riley, Can. Ent. Vol. XV, p. 158.
Riley, 5th Rep. U. S. Ent. Com., p. 620.
Fletcher, Rep. Ent. Soc., 1882, pp. 79, 80.
Packard, 5th Rep. U. S. Ent. Com., 1890, p. 615.
Beutenmüller, Cat. of Gall Insects, 1892, p. 275.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 35.

Fig .37.

A cylindrical, dense woody gall with bluntly rounded apex and slightly contracted at the point of attachment to the leaf. Always on the underside of the leaf. On the upper surface of the leaf opposite the gall is a concave depression. Very common on the hackberry (*Celtis occidentalis*).

APHIDÆ.

HORMAPHIS HAMAMELIDIS Fitch. *Fig. 38.

Byrsocrypta hamamelidis—

Fitch, N. Y. Cat. of Hom. Insects, 1851, p. 69.

Hormaphis hamamelidis—

Osten-Sacken, Stett. Ent. Zeitung, 1861, p. 422.
Walsh, Proc. Ent. Soc. Phil., VI, 1866-67, p. 281.

Hamamelistes cornu—

Shimer, Trans. Am. Ent. Soc., I, 1867, p. 283.

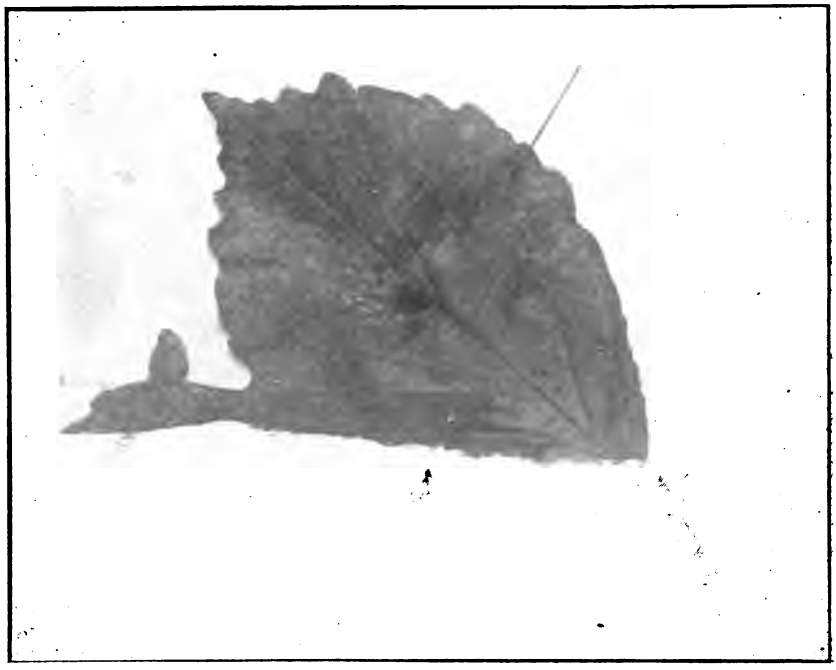


Fig. 38.

Hormaphis hamamelidis—

Thomas, Trans. Ills. State Hort. Soc., 1876-77, p. 199.
Beutenmüller, Cat. of Gall Insects, 1892, p. 276.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 36.
Pergande, The Life History of Two Species of Plant-Lice inhabiting both witch-hazel and birch, 1901, p. 7.

A conical, monothalamous gall produced on the upper surface usually at the angle formed by midrib and on the principal vein of the leaf. The opening on underside. Common on the witch-hazel (*Hamamelis virginica.*)

HAMAMELISTES SPINOSUS *Shimer. Fig. 39.

Hamamelistes spinosus—

Shimer, Trans. Amer. Ent. Soc., Vol. I, p. 284, 1867.

Hormaphis spinosus—

Riley and Monell, Bull. U. S. Geol. Surv. Terr., Vol. V, No. 1, p. 14, 1879.

Hormaphis papyraceæ—

Oestlund, Geol. and Nat. Hist. Surv. of Minn. Bull. 4. Synopsis of Aphidæ of Minn., p. 13, 1887.

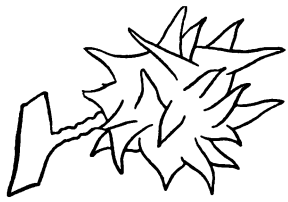


Fig. 39

Hormaphis spinosus—

Beutenmüller, Cat. of Gall Insects, 1892, p. 276.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 25.

Hamamelistes spinosus—

Pergande, The Life History of two species of plant-lice inhabiting both the witch-hazel and birch, 1901, p. 25.

This gall is a deformed fruit bud. It is oblong, green and covered with long spines. At the base of the gall is a funnel-like exit. On *Hamamelis virginica,* but not so abundant as *H. hamamelidis.*

COLOPHA ULMICOLA Fitch. Fig. 40.

Brysocrypta ulmicola—

Fitch, 5th Rep. Nox. Ins. Trans. N. Y. Agricul. Soc., 1858, p. 843.

Thelaxes ulmicola—

Walsh, Proc. Ent. Soc. Phil. Vol. I, p. 305.

Walsh, Am. Ent. Vol. I, p. 108.

*Pergandi gives a most excellent description of the life history of these two species. H. hamamelidis has seven generations and H. spinosus has six generations.

Fig. 40.

Colopha ulmicola—

Monell, Can. Ent. Vol. IX, p. 102.

Glyphina ulmicola—

Thomas, 3d Rep. Nox. Ins. Ill., p. 142.

Colopha ulmicola—

Riley, Bull. U. S. Geo. Sur. (Hayden), Vol. V, p. 9, 1879.
Beutenmüller, Cat. of Gall Insects, 1892, p. 276.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 37.

A cockscomb gall formed on the upper side of the leaf. The opening is on the under surface of the leaf. Green, frequently tinged with red. Very common and very widely distributed on the elm (*Ulmus Americana*).

PEMPHIGUS ULMI-FUSUS Walsh.

Pemphigus ulmi-fusus—

Walsh, Am. Ent. 1: 106, 1861.
Thomas, Rept. Ent. Ills. 8: 153, 1880.
Oestlund, Aph. Minn. 24, 1887.
Packard, Forest Ins., 1890.
Hunter, The Aphidæ of N. A., Iowa Agricul. Ex. Station, 1901, p. 77.

A small conical-shaped gall, contracted at the point of contact with the leaf. Always on the upper surface, but with the opening on the under surface. Common on the elm (*Ulmus Americana*).

PEMPHIGUS POPULICAULIS Fitch. Fig. 41.

Pemphigus populicaulis—

Fitch, Rept. Ins. N. Y. 5: 845, 1859.
Walsh, Proc. Ent. Soc. Phil. 1: 305, 1861.
LeBaron, 3d Rep. Nox. Ins. Ill., p. 193, 1873.
Thomas, 3d Rep. Nox. Ins. Ill. (Trans. Dept. of Agricul., 1878), p. 149.
Walsh and Riley, Am. Ent. 1: 57, 245, 1880.

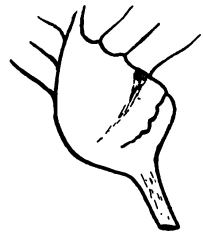


Fig. 41.

Henry, Am. Ent. 1: 205, 1880.
Oestlung, Aph. Minn., 21, 1887.
Packard, 5th Rep. U. S. Ent. Com., p. 471, 1890.
Osborn, Cat. Hem. Ia., 1892, p. 130.
Beutenmüller, Cat. of Gall Insects, 1892, p. 277.
Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 38.
Gillette and Baker, Hem. Colo., 1895, p. 115.
Hunter, The Aphididæ of N. A. Iowa Ex. Station, 1901.

A more or less irregular spherical gall at point of union of petiole and leaf. Opening closed by a twisting of the leaf against the gall. Collected by C. C. Deam in Wells County on *Populus deltoides.* Widely distributed and reported from New York on *Populus monilifera,* and from Illinois on *P. angulata.*

PEMPHIGUS POPULI-TRANSVERSUS Riley. Fig. 42.

Pemphigus populi-transversus—

Riley, Bull. U. S. Geol. Surv. 5: 15, 1880.
Osborn, Cat. Hem. Ia., 130, 1892.
Bruner, Rept. Nebr. Hort. Soc., 361, 1893.
Lintner, Rept. Ent. N. Y. 13: 361, 1899.
Oestlund, Aph. Minn. 21, 1887.
Gillette and Baker, Hem. Colo., 116, 1895.
Hunter, The Aphididæ of N. A., Iowa Ex. Station, 1901.
Packard, 5th Rep. U. S. Ent. Com., p. 434, 1890.

Fig. 42

An oval gall formed on one side of the petiole and causing it to become curved. On the side opposite the petiole is the slit opening which is sometimes contracted into a circular opening. Specimen collected by C. C. Deam in Wells County on cottonwood (*Populus deltoides*). Widely distributed and also occurring on *P. monilifera* and *P. balsamifera.*

PEMPHIGUS VAGABUNDUS Walsh. Fig. 43.

Pemphigus vagabundus—

Walsh, Proc. Ent. Soc. Phil. I: 306, 1861.
Walsh and Riley, Am. Ent. I: 57, 100, 1861.
Packard, Forest Ins., 434, 1890.
Oestlund, Aph. Minn., 22, 1887.

Osborn, Cat. Hem. Ia., 130, 1892.
Cowen, in Hem. Colo., 116, 1895.
Hunter, The Aphididæ of N. A., Iowa Agricul. Ex. Station, 1901.

This an apical bud gall in which the leaves are so distorted as to have lost their identity as leaves. Each part is a double laminæ and between these two laminæ are large numbers of insects. I

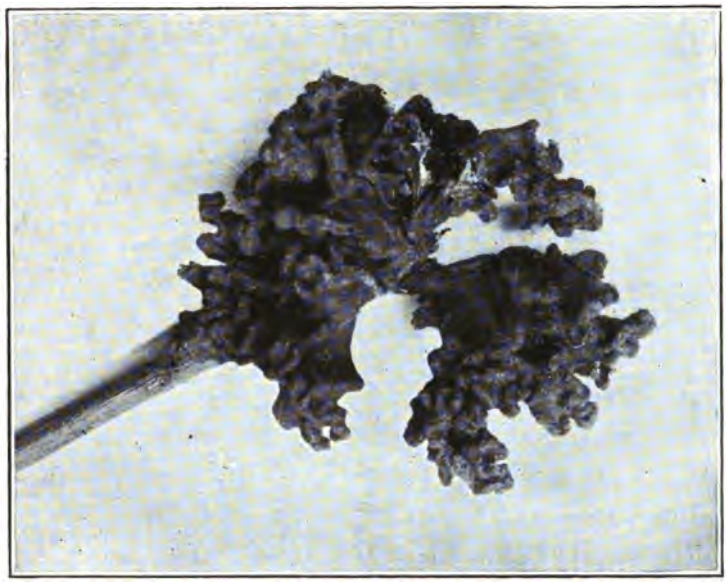


Fig. 43.

have frequently found a single fold in the leaf forming a gall very similar to *Colopha ulmicola*. I have collected this gall on the cotton wood (*Populus deltoides*) in Putnam County and Mr. F. C. Senour of New Augusta, Indiana, has sent specimens to me.

SCHIZONEURA AMERICANA Riley.

Schizoneura Americana—

Riley, Bull. U. S. Geol. and Geog. Surv., p. 4, 1879.
Packard, 5th Rept. U. S. Ent. Com., 1890, p. 279.

A wrinkling and rolling of the leaf of the common elm (*Ulmus Americana*). Very common and very widely distributed.

PHYLLOXERA CARYAEVENÆ Fitch.

Phylloxera caryaevenæ—

Fitch, Rept. Ent. N. Y. 3: 444 (Pemphigus), 1856.
Osten-Sacken, Stett. Ent. Zeit. 22: 421, 1861.
Thomas, Rept. Ent. Ill. 8: 162, 1880.
Oestlung, Aph. Minn. 18, 1887.
Packard, Forest Ins. 322, 1890.
Hunter, The Aphididæ of N. A. Iowa Agricul. Ex. Station, p. 71, 1901.
Pergande, North Amer. Phylloxerinæ, 1904, p. 239.

This gall is a folding of the leaf along the veins; the elevation being on the upper surface and the opening below. The opening is guarded with a mass of hair-like growth. Common on the hickory (*Hicoria alba.*)

PHYLLOXERA CARYÆ-GLOBULI Walsh.

Phylloxera caryæ-globuli—

Walsh, Proc. Ent. Soc. Phil. 1: 309, 1862.
Walsh, Proct. Ent. 2: 120, 1867.

Dactylocphœra hemisphericum—

Shimer, Trans. Am. Ent. Soc. 2: 387, 1869.

Phylloxera caryæ-globuli—

Riley, Rept. Ins. Mo. 7: 117, 1875.
Thomas, Rept. Ins. Ill. 8: 164, 1880.
Oestlund, Aph. Minn. 18, 1887.
Packard, Forest Ins. 322, 1890.
Hunter, The Aphididæ of N. A. Iowa Agril. Ex. Station, 1901.
Pergande, North Amer. Phylloxerinæ, 1904, p. 222.

A hemispherical-shaped gall on the upper surface of the leaf, opening on the under surface by means of a narrow slit. Frequently one-fourth inch in diameter. Common on hickory (*Hicoria alba*).

PHYLLOXERA CARYÆ-FALLAX Walsh. Fig. 44.

Phylloxera caryæ-fallax—

Walsh, Rept. Ent. Ill. 1: 23, 1868.
Thomas, Rept. Ent. Ill. 8: 164, 1860.

Riley, Rept. Ins. Mo. 6: 118, 1874.
Oestlund, Aph. Minn. 18, 1887.
Packard, Forest Insects, 323, 1890.
Hunter, The Aphidæ of N. A., Iowa Agril. Ex. Station, 1901.
Pergande, North Amer. Phylloxerinæ, 1904, p. 214.

Fig. 44.

A cone-shaped gall on the upper surface of the leaf. Opening is through the apex of a much shorter cone on the under surface of the leaf. Frequently so abundant as to seriously injure the foliage. Common on the hickory (*Hicoria alba.*)

PHYLLOXERA CARYÆ-CAULIS Fitch. Fig. 45.

Phylloxera caryæ-caulis—

Fitch, Rept. Ins. N. Y. 1: 155-159 (*Pemphigus*), 1855.
Osten-Sacken, Stett. Ent. Zeit. 22: 421, 1861.
Riley, Rept. Ins. Mo. 117, 7: 1875.
Thomas, Rept. Ent. Ill. 8: 160, 1880.
Oestlund, Aph. Minn. 18, 1887.
Packard, Forest Insects 322, 1890.
Hopkins, Can. Ent. 28: 243, 1897.
Hunter, The Aphididæ of N. A., Iowa Agril. Ex. Station 70, 1901.

Fig. 45.

Dactylosphæra subellipticum—

Shimer, Trans. Am. Ent. Soc. 2: 387, 1869 (Riley).

Dactylosphæra caryæmagnum—

Shimer, Trans. Am. Ent. Soc. 2: 391, 1869 (Riley).
Pergande, North Amer. Phylloxerinæ, 1904, p. 244.

A hemispherical gall, variable in size, on stem, petiole or ribs of the leaves. A small opening in the summit. Extremely variable. I have sometimes found these galls very large, completely surrounding the stem and with no visible opening, but completely filled with insects of various ages. Common on the hickory (*Hicoria alba*).

PHYLLOXERA CARYÆ-DEPRESSA Shimer.

Dactylosphæra conifermis—
Shimer, Trans. Am. Ent. Soc. 2: 397, 1868.

Phylloxera caryæ-depressa—
Shimer, Trans. Am. Ent. Soc. 2: 390 (*Dactylosphæra*), 1868.
Riley, Rept. Ins. Mo. 7: 118, 1875.
Lintner, Rept. Ins. N. Y. 6: 189, 1889.
Oestlund, Aph. Minn., 18, 1887.
Packard, Forest Ins. 323, 1890.
Hunter, The Aphididæ of N. A., Iowa Agril. Ex. Station, 1901.
Pergande, North Amer. Phylloxerinæ, 1904, p. 208.

A depressed leaf gall similar to *P. caryæ-globuli,* but much more depressed. The gall is on the upper surface of the leaf and the opening below. The opening fringed with hair.

PHYLLOXERA VASTRATRIX Planchon. Figs. 46, 47.

Phylloxera vastratrix—
Planchon, Comp. Rend. Acad. Sci., Paris, Sept. 14, 1868.
Riley, Rept. Ins. Mo. 7: 117, 1875.
Osborn, Cat. Hem. Ia. 130, 1892.
Hunter, The Aphididæ of N. A., Iowa Agril. Ex. Station, 1901.

Phylloxera vitifoliæ—
Fitch, Rept. Ins. N. Y. 1: 158, 1855.
Fitch, Rept. Ins. N. Y. 3: 117, 1856.
Walsh, Proc. Ent. Soc. Phil. 1: 305 (*Bysocrypta*), 1862.
Shimer, Proc. Acad. Nat. Sci. Phil., 1867.
Thomas, Rept. Ent. Ill. 8: 158, 1880.
Oestlund, Aph. Minn. 18, 1887.
Riley, Rept. Ent. Mo. 7: 117, 1875.

A small rough gall on either upper or lower surface of the leaf, but most often upon the upper. Frequently the leaves are absolutely covered with this gall and its usefulness to the plants practically destroyed. Another generation of this insect forms galls upon the roots and it is in this stage that it causes considerable

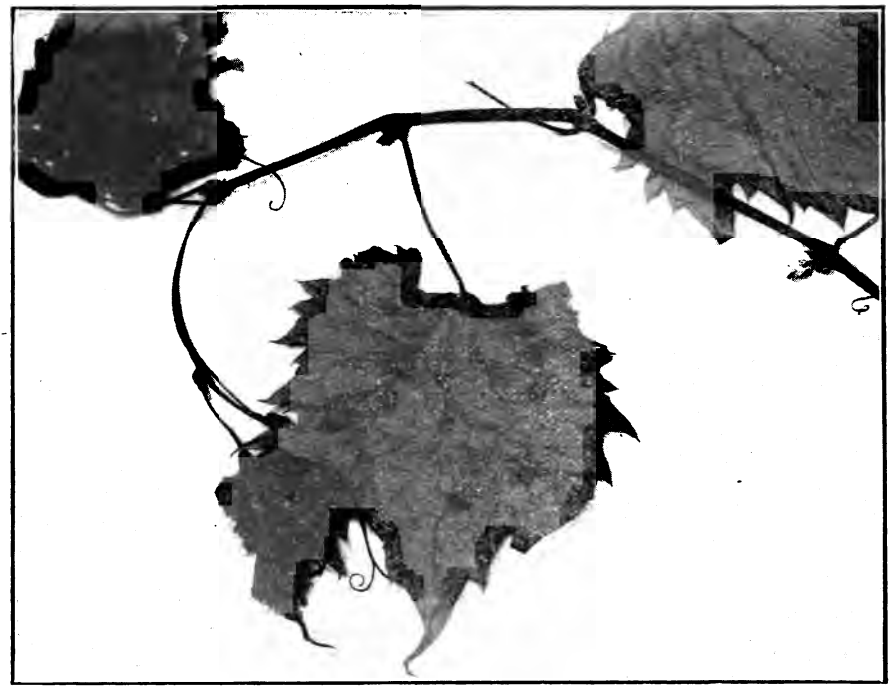


Fig. 46

destruction among many varieties. Attacks a great many species and varieties. Common on many of our wild and cultivated grapes. The writer has collected it on *Vitis vulpina* and *V. bicolor*. Widely distributed throughout North America and Southern Europe.

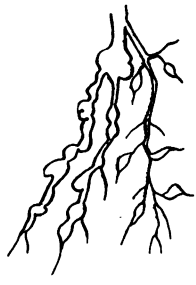


Fig. 47

LEPIDOPTERA.

GHLECHIIDÆ.

GNORIMOSCHEMA GALLÆSOLIDAGINIS Riley. Fig. 48.

Gelechia gallæsolidaginis—

Riley, Mo. Rep. Nat. Inst. I, 1869, p. 173.
Riley, Mo. Rept. Nat. Inst. II, 1870, pp. 20, 132, 134.
Smith's List Lep. Bor. Am., No. 5377, 1891.
Chambers, Can. Ent., VIII, 1876, p. 19.
Chambers, Can. Ent., IX, 1877, p. 14.
Cinn. Quart. Journ. Sci. II, 1875, p. 289.

Fig. 48.

Bull. U. S. Geol. Surv., III, 1877, pp. 1, 28, 141.
Bull. U. S. Geol. Surv. IV, 1878, pp. 115, 143.
Kellicott, Can. Ent., X, 1878, p. 201.
Dietz, Smith's List Inst. N. Jersey, 1900, p. 474.

Gnorimoschema gallæsolidaginis—

Busck, Proc. U. S. Nat. Mus. XXIII, 1900, p. 227.
Dyar's List Amer. Lep. No. 5620, 1903.
Proc. U. S. Nat. Mus. XXXI, p. 824.

A large elongated stem gall with very large larval chamber containing a single large larva. Very common on golden-rods (*Solidago canadensis*).

ARACHNIDA.

ERIOPHYIDÆ. (PHYTOPTIDÆ).

ACARUS SEROTINÆ Beutemüller. Fig. 49.

Acarus serotinæ—

Beutenmüller, Cat. of Gall Insects, 1892, p. 278.

Beutenmüller, Amer. Mus. Jour. Vol. IV, No. 4, 1904, p. 38.

Fig. 49.

A pouch-like gall about two-fifths inch in length, connected with the upper side of the leaf by means of a constricted neck. The opening on the underside of the leaf. Common on the wild cherry (*Prunus serotina*).

ACARUS SEMEN Walsh.

Cecidomyia salicis-semen—

Walsh, Proc. Ent. Soc. Phil. Vol. III, pp. 543-644.

Acarus semen—

Walsh, Proc. Ent. Soc. Phil. Vol. IV, pp. 223-288.

A small gall with roughened surface usually occurring on the upper, occasionally on the lower surface of our common willows. The opening on the opposite surface from the gall.

ACARUS ÆNIGMA Walsh.

Cecidomyia salicis ænigma—

Walsh, Proc. Ent. Soc. Phil. III, pp. 543-644.

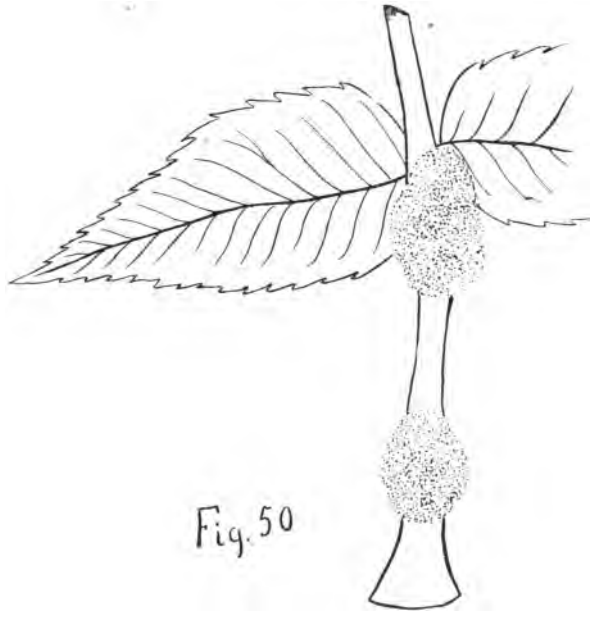
Acarus ænigma-—

Walsh, Proc. Ent. Soc. Phil. IV, pp. 223-288.

A large leaf gall made up of a core covered with small filamentous structures which in old galls are frequently so fine as to be almost silky in appearance. In some cases only a part of a single leaf will be affected, at other times the entire leaf and sometimes the mass of leaves from a single leaf bud will be affected, thus producing a large gall which may remain on the tree during the entire winter. Common on the willows.

ACARUS CAULIS Walsh. *Fig. 50.

A reddish, later brownish swelling covered with woolly puberescence found on the petiole, ribs and large veins of the leaves of



our black walnut (*Juglans nigra*) and causing a bending of the parts affected. Frequently so common as to be injurious to young trees.

*I have been unable to secure satisfactory bibliography of this gall. It seems to be the same as described by Walsh and referred to in Proc. Ent. Soc. of Phil., Vol. III, p. 227. Miss L. J Martin, in a paper on "Botanical Study of the Mite Gall on the Black Walnut," 1885, gave a discussion of the morphology. It is frequently referred to as Erineum Anomilum.

ERIOPHYES QUADRIPES Shimer.

Vasates quadripes—

Shimer, Trans. Amer. Ent. Soc., May, 1869.

Phytoptus quadripes—

Osborn, Western Stock Jour. and Farmer, Vol. 9, p. 142, 1879.

Osborn, Bull. Iowa Agric. College, No. 2, pp. 54-61, Aug., 1884.

Osborn, Trans. Iowa State Hort. Soc., Vol. 18, pp. 127-135.

Garman, 12th Rep. Ills. State. Ent., 1882.

Lintner, Cult. and Country Gentl., Vol. 53, p. 430, 1888.

Packard, 5th Rept. U. S. Ent. Com., 1890.

Murtfelt, Colman Rural World, April 25, 1895, p. 131.

Felt, Country Gentl., June 1, 1899, p. 430.

Felt, Country Gentl., June 22, 1899, p. 486.

Eriophyes quadripes—

Banks, Proc. Nat. Mus. Vol. XXVIII, p. 106.

Small galls, varying somewhat in size, usually discoidal or spherical on the upper side of the leaf and connected with it by a slightly constricted neck. In the spring and summer about the same color as the leaf, but in the late summer or fall becoming purplish and finally black and dry. Common on our soft maple (*Acer saccharinum*).

ERIOPHYES ACERICOLA Garman.

Phytoptus acericola—

Garman, 12th Rep. Ills. State. Ent., 1882.

Packard, 5th Rept. U. S. Ent. Com., p. 424, 1890.

A small spindle-shaped gall about one-fifth inch in length attached to the upper surface of the leaf by one end. Same color as leaf, sometimes reddish or purplish. Common on our soft and sugar maples (*Acer saccharinum* and *A. saccharum.*)

ERIOPHYES ABNORMIS Garman. Fig. 51.

Phytoptus abnormis—

Garman, 12th Rept. Ills. State Ent., 1882.

Phytoptus abnormis—

Packard, 5th Rept. U. S. Ent. Com., p. 480, 1890.

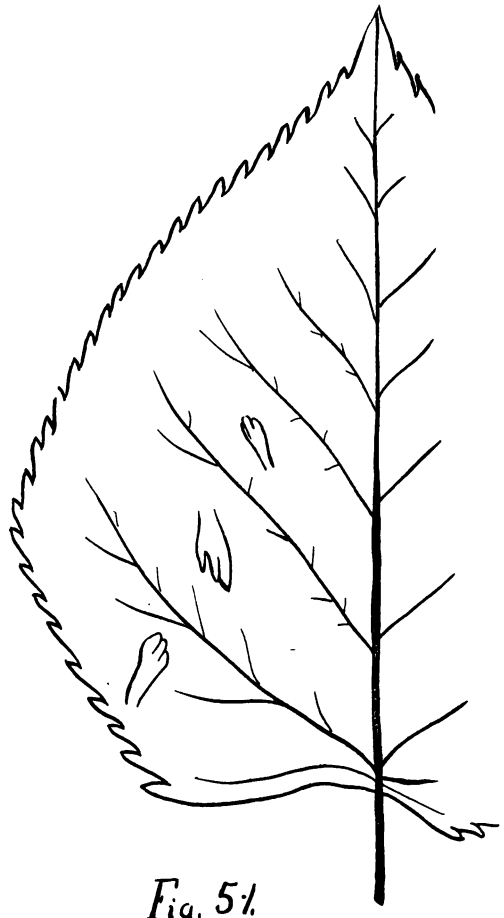


Fig. 54

An elongated club-shaped gall, attached to the upper, occasionally lower, surface of the leaf by the small end. The walls deeply infolded and notched at the end. Same color as the leaf. Common on the linden or bass wood (*Tilia Americana*).

ERIOPHYES ULMI Garman.

Phytoptus ulmi—

Garman, 12th Rept. Ills. State Entomol., 1882.

Phytoptus ulmi—

Packard, 5th Rept. U. S. Ent. Com., p. 281, 1890.

A small more or less spherical gall with slightly constricted neck occurring very abundantly upon the upper surface of our elms (*Ulmus Americana*).

ERIOPHYES FRAXINI Garman.

Phytoptus fraxini—

Garman, 12th Rept. State Ent. of Ills., 1882.

Packard, 5th Rept. U. S. Ent. Com., p. 554, 1890.

A small irregular more or less spherical gall occurring on the upper surface of the leaves of our common green ash (*Fraxinus viridis*). A similar gall also occurs on the green ash (*F. Americana*).

ERIOPHYES SALICICOLA Garman.

Phytoptus salicicola—

Garman, 12th Rep. Ills. State. Ent., 1882.

A small, rather irregular more or less spherical gall occurring in great abundance on the upper surface of the leaves of willow (*Salix sp.* —).

ERIOPHYES sp.

Phytoptus sp.—

Garman, 12th Rep. Ills. State. Ent., 1882.

A small, more or less irregular, spherical gall which very frequently unites with its neighbor into large patches on the upper surface of the leaves of the poison ivy (*Rhus toxicodendron*).

ERIOPHYES sp.——, and SPHÆROTHECA PHYTOPTOPHILA Kell and Sw. Fig. 52.

Phytoptus sp.———, and *Sphærotheca phytoptophila*—

Kell and Sw., Kan. Agri. Ex. Station Rept., 1888, pp. 302 315.

Sphærotheca phytoptophila—

Kell and Sw., Journal of Mycology Vol. IV (1888), pp. 93 94.

An Eriphyes and fungus associated and forming a witch-broom gall on hackberry (*Celtis occidentalis*). These galls are very numerous on the branches and twigs and range from ½ to 1½ inches in diameter and each gives rise to a large number of smaller twigs. They injure the tree by causing unsightly disfigurations, loss of nourishment in forming galls, and give points of decay which sometimes extend to the trunks and cause the death of the tree.

Fig. 52.

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